THE
ELECTRICAL REVIEW

Volume CXXIX — No. 3326

Friday, August 22, 1941

Contents

	Page		Page
Editorial—Wind and Tide	113	New Books	128
Reclaiming Waste Paper	115	Prospects in Canada. By E. Arthur Pinto	129
Personal and Social	118	The Higher-Voltage Trend. By C. J. O. Garrard	131
Correspondence	119	Power for Aluminium Production	133
Film Studio Installation	120	New Patents	134
Surge Phenomena	121	Commerce and Industry	135
Domestic Consumption in War-time. By G. V. Harrap	123	Electricity Supply	138
Laboratory Furnaces. By P. Morris	124	Financial Section	140
Static Electricity on Motor Vehicles. By A. M. Spruce.	127	Contract Information	146
Classified Advertisements	51	Index to Advertisers	62

EDITORIAL, ADVERTISING AND PUBLISHING OFFICES: Dorset House, Stamford Street, London, S.E.1

Telegraphic Address: "Ageekay, Sedist, London." Code: A B C. Telephone No.: Waterloo 3333 (35 lines)
Registered at G.P.O. as a Newspaper and Canadian Magazine rate of postage. Entered as Second Class Matter at the New York, U.S.A., Post Office.

Subscription Rates, Postage free: United Kingdom, £1 14s. 8d.; Canada, £1 12s. 6d.; Colonial and Foreign, £1 14s. 8d. per annum.

Cheques and Postal Orders (on Chief Office, London) to be made payable to ELECTRICAL REVIEW LTD., and crossed "Lloyds Bank"

By Appointment to His Majesty King George VI.

HART BATTERIES

FOR

AIR-RAID SHELTERS, CONTROL CENTRES AND WARDENS' POSTS

RADIO STATIONS, POWER STATIONS AND TELEPHONE EXCHANGES

PUBLIC, PRIVATE & COMMERCIAL BUILDINGS, HOSPITALS & CINEMAS

also

EMERGENCY ELECTRIC LIGHTING EQUIPMENT

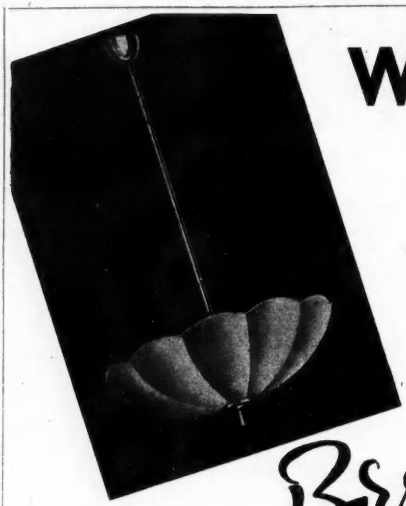
CATALOGUES, ESTIMATES AND SPECIFICATIONS ON APPLICATION

HART ACCUMULATOR COMPANY LTD.

STRATFORD, LONDON, E.15

Telephones: Maryland 1361-1363.
Telegrams: "Hartmossel, Strat, London."
Codes: A B C (5th & 6th editions) and Bentley's.

Branches: Birmingham, Bristol, Cardiff, Cork, Dublin, Glasgow, Manchester, Newcastle-on-Tyne, Nottingham, Westminster



We like—

—this fitting, so will you when you have seen the lustre and colour of the Berryphane glass. It is only one of some hundreds of designs.

Write for a catalogue "Lighting of To-day," by Berry's, NOW

Berry's ELECTRIC LTD.

Touchbutton House
NEWMAN STREET
LONDON
Tel.: MUSeum 6800 (9 lines)
Also BIRMINGHAM
MANCHESTER and
NEWCASTLE-ON-TYNE

CAMBRIDGE

ELECTRICAL & MECHANICAL INSTRUMENTS

AS the CAM and the BRIDGE are mechanical and electrical symbols, and CAMBRIDGE is a seat of science and learning, so CAMBRIDGE PRODUCTS bearing this trade mark embody the scientific application of engineering principles in design. Sixty years of continuous development have gone into their making.

Data of over 120 ELECTRICAL INSTRUMENTS are given in FOLDERS 53-X and 54-X.

CAMBRIDGE
INSTRUMENT CO. LTD.
13 GROSVENOR PLACE
LONDON S.W.1

THE
ELECTRICAL REVIEW
THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXIX. No. 3326. AUGUST 22, 1941 6d. WEEKLY

Wind and Tide

Problems of Electricity Generation

TO the layman the exploitation of natural resources that are now going to waste may appear as presenting a golden opportunity of getting something for nothing. To the engineer the obstacles in the way of their economic application often appear well-nigh insuperable; indeed, the utilisation of " waste " may prove to be an exceedingly costly method of obtaining power.

Thus, the proverbially fickle wind has hardly been regarded seriously in connection with the generation of electricity on any appreciable scale. Nevertheless, " Ill blows the wind that profits nobody " is apparently the belief of the Central Vermont Public Service Corporation, which is connecting to its 44-kV system a 1,000-kW 2.3-kV wind-driven alternator, said to be the first of its kind.

In describing the equipment *Power* states that the plant, which is installed at a height of 2,000 ft. (the hill bearing the egregious name of Grandpa's Knob), is expected to run for about 4,000 hours in the year—nearly three-quarters of the time on full load. Possibly the most important feature of the station is its association with a wind-power research laboratory, in which fundamental and engineering knowledge can be gained for the economic design and construction of wind-driven generating units in the future.

In contrast to the erratic behaviour of the wind is the exactly predictable ebb and flow of the tide, which in this respect has an advantage over waterfalls that depend upon seasonal and weather vagaries. Its punctuality is not enough, however, to compensate for its intermittent action and so a purely tidal scheme would have to be debited with the standing charges on steam plant required for filling in the valleys.

It was estimated to be much less expensive in overall costs to provide 550,000 kW by steam plant than to harness the River Severn for the purpose. Only by virtually changing the scheme to a more ordinary hydro-electric layout could power from the tide compete with coal for generating electricity; that is by using a large proportion of the tidal energy to pump water to a reservoir for driving other turbines in the slack periods.

A similar idea was behind the Passamaquoddy project for producing 80,000 kW from the River Maine. Even then production cost has been estimated at nearly twice that obtainable with a modern steam plant. As an addendum to his report to the United States Federal Power Commission, the chief engineer, Mr. R. B. McWhorter, envisages an elaborate seventeen-project programme, of which Passamaquoddy would form a part, in which case the cost per kWh would be substantially less than that obtainable with steam.

A great handicap to the development of tidal power is the length of time involved in construction—in the case of the Severn Barrage the capital expended would be unremunerative for about fifteen years. Moreover, contingencies are less easily covered by a reasonable percentage than

they are with thermal stations. The favourable margin shown by the British scheme in comparison with steam will have increased materially since the report was published some eight years ago. Much would depend upon the value of improved railway and road connections between England and South Wales with which the proposals were associated, but unless some improvement in the coal position is to be anticipated after the war, the report might well be re-examined in the light of more recent developments.

Hire-Purchase

THE hire-purchase system has been a most potent agent in building up the electrical load in this country, particularly the domestic part of it, but what has been done here is insignificant in comparison with the immense American hire-purchase business. The war has affected the system here in two ways. In the first place the drastic reduction in the manufacture of appliances, coupled with the Limitation of Supplies Order, has cut down the number of appliances available, and secondly the unwillingness of electricity supply authorities and others to incur doubtful war-time risks has led to the suspension of facilities. Nevertheless, the domestic load has sustained little real damage. Now the United States, under the stress of war production, finds it necessary to curtail hire-purchase facilities very drastically. While we hope that the effect upon our transatlantic electrical colleagues will not be any worse than it has been here we feel that their intensified system may not withstand the shock so well. But the Americans are a resilient people and will not suffer permanent harm.

Transformer Maintenance

THE present-day transformer is often taken as a first-class example of reliability of electrical apparatus. It was not always so. In earlier days ageing of the iron shortened its life. Information received by the Edison Electric Institute from twenty-five American undertakings operating some 500,000 transformers gives round about 1910 as the time when developments in electrical and magnetic design began to be effective. Troubles with transformers built within the past few years are proportionately only one-tenth of those with units commissioned before that date. The number repaired last year averaged 8 per cent. of the total in service, and no transformers constructed since 1910 were removed because of length of time in service. This improvement is all the more notable on account of the reduced coil surface for oil circulation with recent designs and hence the relative importance of sludge in ducts. That is not to say, however, that an oil possessing a low sludge value is necessarily the best for insulation.

Shock Intensity

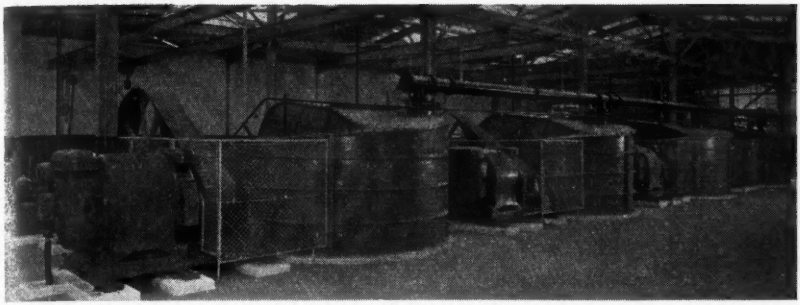
INVESTIGATIONS into the maximum safe currents for human beings are reported in *Electrical Engineering*. The criterion is taken as the current at which release from a charged conductor can be effected by using the muscles directly affected. For 114 men the average figure with AC at power frequency was 15.5 mA, but it was calculated that one man in two hundred would not be able to let go at a value of 8.8 ± 0.8 mA, which was consequently taken as setting the maximum for safety, although with women and children it might be less. While current provides, strictly, the correct basis it introduces variable factors, so that voltage provides the practical standard, as in the latest edition of the I.E.E. Regulations regarding earth-leakage breakers.

Seeking the Light

ALTHOUGH the desire of the moth for the star may be but a poetic conception, the attraction of light to insect pests may be a substantial nuisance in some climates. Their unwelcome visitations can be alleviated by avoiding light that approaches the blue end of the spectrum and high intrinsic brightness. Experiments reported in the *G.E.C. Review* show that lamps giving a white light need to be of a considerably lower wattage than those emitting red rays in order to secure the same results. As red light is not very suitable for working under, yellow would appear to present a reasonable compromise.

No Dilution

AN Irish correspondent tells us that while the Dublin Gas Co. is reducing the calorific value of its product, a "spokesman" (that word again !) of the Electricity Supply Board has given an assurance that it "does not at present contemplate a reduction in the voltage or thermal value of the current supplied."



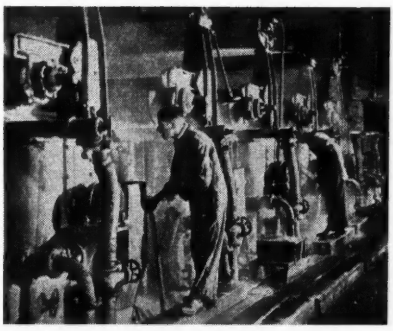
Beaters for reducing waste paper to pulp

Reclaiming Waste Paper

Electricity's Part in the Salvage Campaign

SINCE the National Salvage Campaign was started in November, 1939, over 400,000 tons of waste paper has been recovered and used again, thereby releasing the cargo space in about seventy-five ships for the importation of other materials of more vital need. It is not generally realised that this remarkable contribution towards the war effort would not have been possible but for the assistance of electricity in the re-pulping and re-manufacturing processes.

Actually one large company alone utilises approximately a hundred million kWh of electricity a year in making, almost entirely from waste paper, cardboard which is required not only for boxes, packing cases, etc., for normal peace-time uses but also for numberless articles connected with munitions of war, such as fuse-holders for shells and bombs; containers for shells and bullets; tubes for shell linings; rings, wads, washers, cups for shell interiors; components of flares and rockets; valve covers for aero engines; targets; cap peaks; drums for cables; wallboard for lining huts; and boxes for gas masks and many other purposes.



Vats where a continuous sheet of cardboard is formed

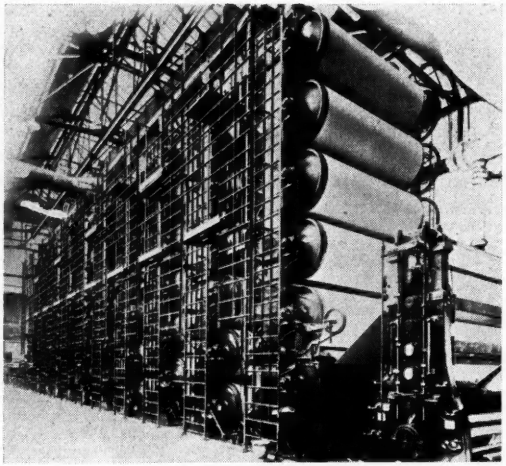
As our readers are probably aware, both paper and cardboard are made of innumerable tiny hair-like fibres. These fibres are obtained (except in the case of a small quantity of expensive paper for which rags are used) from wood pulp which is procured from the trunks of trees by grinding or treating with chemicals or else from grasses such as esparto or straw. As the fibres from the tree, grass or straw, are not easily destroyed it is possible for used paper or cardboard to be beaten up and cleaned and re-made.

In the re-manufacturing process steam, as well as electricity, plays a big part, with the result that in general the manufacturers find it more economical, rather than purchasing supplies from the local undertakings, to generate their own electricity and use waste steam for the process work. For this purpose, back-pressure turbines are commonly used, and the steam and electricity demand is balanced as nearly as is practicable, the final adjustment being made by means of a condenser set.

Practically every stage of the work requires the use of electricity, and it is interesting to follow through the various applications step by step. On arrival at the re-pulping mills the raw materials, together with large quantities of coal, have to be conveyed from trucks, lorries, or barges to

the receiving stores. For this purpose electric cranes, driven by motors of up to about 55 HP, have established their advantages over other methods. From the stores the waste paper is taken as required to the beaters, large oval vats in which, assisted by hot water and chemicals, revolving rolls carrying knives cut or churn the paper up into pulp. These beaters, according to type, require motors of anything from 75 to 250 HP.

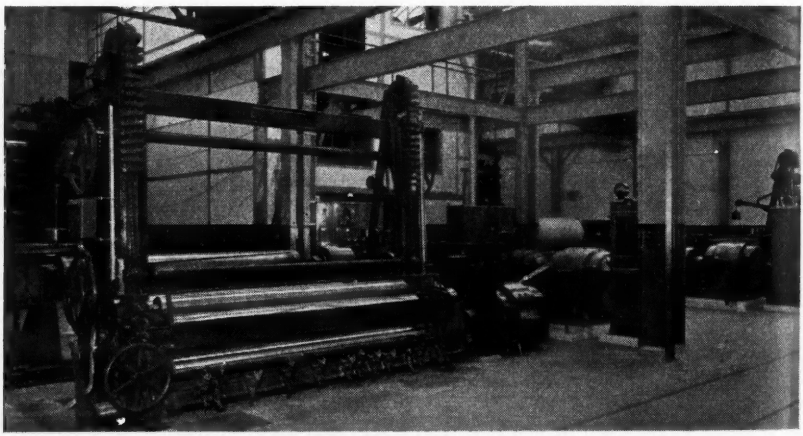
After beating, the raw material is in fluid form, and pumps (with motors of from 12 to 60 HP) pass the "stock," as the pulp is called, through the various processes. In the refiners, this stock is still further processed until the waste paper has been reduced to its elemental fibres. Each refiner is fitted with a motor of from 100 to 200 BHP. The suspension of fibre in water is then pumped to screens where any lumpy pieces of material still remaining are strained out. After this the stock passes through various other processes, first of all being brought to a uniform consistency by means of a number of mixing chests equipped with motor-driven agitators.



A modern boardmaking machine

Finally the stock is pumped into the paper or board machine vats where in a remarkable way the microscopic fibres adhere to the rough hairs of an endless woollen felt and are gradually formed into an endless layer of cardboard as the felt progresses from vat to vat. This process is accomplished by straining the fibres from the stock, and depends upon what might be called "friction adhesion" between the fibres and the felt. At the end of the operation a wide continuous sheet of paper or board has been formed. A conveyor belt on which the felt revolves is driven through reduction gears by motors which generally have a rating of about 10 HP.

At this stage the paper or cardboard is, of



After paper or cardboard has been dried and calendered it is reeled and cut into sheets. Here are typical reel winders and their drives

course, very wet. Accordingly it is taken through suction presses which remove most of the water preparatory to its passing to the dryer sections of the machine. These dryers are actually steam heated cylinders and it is here that the large quantities of process steam are used, for on some of the largest machines there may be 150 of these dryers. When the product is dry the necessary smoothness is imparted by means of calenders and it is then ready for winding on to drums, after which it is cut into smaller rolls or sheets ready for use. A complete board machine, exclusive of preparatory plant, may weigh anything up to 2,000 tons and measure as much as 300 ft. long by 15 ft. wide by 50 ft. high. Such a machine is capable of turning out its own weight of board in a week.

Types of Electrical Equipment Used

Although a little conservative, paper makers have now learned to appreciate the fine control obtainable by means of the electric drive. On a machine in one works, for instance, there are twenty-six motors running in synchronism and adjustable to within a half of one per cent. of each other. Air and temperature control are also of great importance to the paper maker and in consequence electrically operated fans of various kinds are employed extensively throughout manufacture. Various electrical systems are used in board mills, high-voltage and low-voltage, AC and DC, the latter being preferred for conditioning plant, stock pumps, etc., many of which have remote speed regulation.

Paper and board machines operate twenty-four hours a day, seven days a week, so that the first essential is reliability. Since ambient temperatures are fairly high, motors and switchgear must be liberally rated and, in addition, capable of withstanding a humid atmosphere. Manufacturers are finding it economical to standardise motor frame sizes, even though this sometimes entails using a larger motor than required. By such standardisation spares are kept to a minimum and motors can be changed for overhaul with the least possible delay. Automatic starters have proved almost a necessity, since they have to be accommodated in positions remote from the plant they control. Local control stations, consisting of stop and start buttons and ammeter, are usually provided, and by this means each operator can see just what his plant is doing.

To facilitate the handling of finished goods very many electric trucks are used in the industry and with two batteries these will give twenty-four hours' service. The capital cost of trucks is fairly high, but 10 to 15 years' hard service can be obtained from them. Some manufacturers in this country have been slow to appreciate the saving obtained by electric trucking, but it is a very real one.

Helping the War Effort

This example of how electricity is helping the war effort is, of course, just part of a wider programme. Nevertheless it is an important one—a fact which should encourage all those connected with the electrical industry. Because there are two sides to the question it is perhaps only fair to mention that our readers can perform a valuable service and help the war effort itself by seeing that their local councils have an efficient waste-paper salvage scheme as part of their municipal cleansing undertaking, and also by arranging to save every scrap of waste paper in their own homes, offices and works.

Measuring Ozone

Electro-chemical Method

THERE has been a long-felt need, particularly among meteorologists, for a better way of measuring the ozone content of the atmosphere. A much simpler procedure than those hitherto employed is described in a recent issue of *Nature* by Professor F. A. Paneth and Dr. E. Gluckanf, of the Chemistry Department and Observatory, University of Durham.

It is an electro-chemical method, being very quick and continuous, so lending itself to automatic recording. Air enters the apparatus at high speed through a nozzle, thereby spraying potassium iodide solution vigorously throughout the vessel, allowing the gas to be absorbed by the liquid without interference of the glass walls. The reaction of ozone to the fine spray of buffered neutral solution is declared to be quantitative even at exceedingly small concentration.

The sprayed liquid is collected and, by the suction of the nozzle, circulated back to the inlet tube. On its way it flows rapidly over two platinum electrodes between which there is a potential difference of 10 mV, but current will pass between them only when the cathode is depolarised by an oxidising agent. This function is performed by free iodine liberated from the solution by absorption of the ozone, less than a millionth part normally permitting the passage of sufficient to be easily measured by a galvanometer. The evaporating water is replaced by periodically adding constant quantities of a greatly diluted solution of thiosulphate for titration, so permitting ozone readings about every two minutes.

PERSONAL and SOCIAL

News of Men and Women of the Industry

AT a meeting of the Willesden Borough Council held on August 12th, **Mr. H. Marshall,** chief clerk, Sunderland Corporation Electricity Department, was appointed commercial assistant.

Dr. H. L. Guy, F.R.S., chief engineer of the Mechanical Dept. of the Metropolitan-Vickers Electrical Co., Ltd., has resigned from that position after thirty years' service.

Mr. J. W. Speight, deputy borough electrical engineer at Leyton, is retiring in February next after thirty-nine years' service at Leyton.

Mr. A. E. Bowden, an electrician in the employment of the Southern Railway, has been awarded the British Empire Medal for his courage and initiative when a wharf was bombed. He extinguished many incendiary bombs and climbed on to a warehouse roof and prevented the spread of fire to valuable plant.

Miss Caroline Haslett, C.B.E., is to deliver her presidential address to the Women's Engineering Society on September 27th at the Institution of Electrical Engineers.

Among those presented to Their Majesties on the occasion of their recent visit to Hull, was **Mr. D. Bellamy,** general manager of the Corporation Electricity Department.

Mr. C. Clarke, transport manager, Birkenhead Corporation, who is due to retire on superannuation, has been re-engaged in a temporary capacity at a salary of £1,000 per annum.

Hull Corporation Electricity Committee has appointed **Mr. T. K. A. Douglas** as power station superintendent.

Mr. R. Bolsover, the technical and sales representative of Steatite and Porcelain Products, Ltd., has recently removed to Bendhill Cottage, Blacksmiths Hill, Sanderstead, Surrey (telephone: Sanderstead 2504).

Obituary

Mr. Joseph Augustine Forde, engineer and manager of the Isle of Thanet Electric Supply Co., Ltd., whose death on August 3rd was reported in our last issue, was born in Cork, Eire, and in 1897 was appointed assistant engineer to the Cork Electric Tramway and Lighting Co. He became resident engineer at Queenstown in 1899, and commenced his association with the Isle of Thanet undertaking in 1902 as chief assistant engineer of the Isle of Thanet Electric Tramways and Lighting Co., Ltd. (as it was then known). He was appointed engineer and manager in 1906. He was a member of the Broadstairs and St. Peters U.D.C., of which he was chairman in 1928 and for about twenty years he had been a J.P. for the Cinque Ports Division of the County of Kent and was a Commissioner of Income Tax and Land Tax. He was also chairman of the S.E. and East England Committee of E.D.A.

The late Mr. J. A. Forde

Mr. C. H. Cox.—We regret to record the death in his sixty-fifth year of Mr. C. Horace Cox, for 19 years a director of the Edison Swan Electric Co., Ltd., and also of Edison Swan Cables, Ltd. Mr. Cox joined the Edison & Swan United Electric Light Co. at Liverpool in 1894, serving under his father, on whose appointment as inspector of the company's depots, Mr. Cox was made manager of the Liverpool branch, a position he held for ten years. In 1921 he was called to the head office, appointed commercial manager, and later elected to a seat on the board. Mr. Cox was Chairman of the E.D.A. Council for 1932-33, and he was one of the oldest members of the E.L.M.A. Council. His son, Mr. H. B. Trevor Cox, is M.P. for Stalybridge.

The late Mr. C. H. Cox

Mr. W. H. Bray.—We regret to record the death, which occurred on August 11th at the age of seventy-four, of Mr. Walter Henry Bray, who, until his retirement in 1934, was electrical engineer to the Middlesex County Council. Earlier in his career he was responsible for some of the first electric lighting stations in the West of England. He joined the Middlesex Education Department in 1904 and for some years was lecturer in electrical engineering at the Chiswick, Ponders End and Hornsey Technical Institutes.

In 1925 he was transferred to the County Architect's department as electrical engineer and was responsible for the installations at schools, institutions and hospitals under the County Council's jurisdiction, including the electrical installation at Shenley Mental Hospital, his service with the County Council being extended so that he could supervise the completion of this work. After his retirement he continued to take an active interest in electrical affairs and was for a time lecturer at the London School of Electrical Domestic Science.

Mr. G. A. Manson.—The death has occurred at Melrose while on holiday of Mr. George Alexander Manson, manager at Newcastle-on-Tyne for Marconi International Marine Communication Co., Ltd.

Mr. W. Beverley Boyd, a prominent Canadian electrical man, recently died at his home in Toronto at the age of seventy. Until his retirement several years ago, he had been president of the Dominion Alloy Steel Corporation, Ltd. His career began with Sir William Mackenzie and his allied electrical enterprises. He acted as chief engineer in all of Sir William's power interests, and was responsible for the 80-mile h.v. transmission line supplying light and power to Toronto.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Hypothetical Justice

THE article under the above heading, by Mr. D. J. Bolton, in your issue of August 1st, raises a number of points of great interest regarding the operation of the Act of 1926 and, in particular, Section 13 of that Act. In this connection it may be of interest to remind your readers that Section 13, as drafted in the original Bill, contained a proviso that this section should operate for only five years, and, had it not been for the deletion of this proviso in the Committee stage of the Bill, all question of hypothetical plant would have long ago disappeared.

Ellesmere, Salop. R. ALAN THWAITES.

Chief Engineers' Salaries

IN reply to Mr. Parker, I would state that the large amount of work and negotiations carried out by the A.M.E.E. in connection with the new salary schedule is fully appreciated and I am pleased to be able to pay my tribute to this work. My whole point has consistently been that the actions and constitution of the A.M.E.E. executive have always been autocratic and selfish and that the fruits of this policy would be to neutralise the work upon which they have been engaged. I consider that my contention is proved by the fact that far less than 50 per cent. of the local authorities are prepared to accept the new agreement. Also, when it is realised that during the whole period from 1938 to 1941 the A.M.E.E. have been negotiating this salary scale with the employers they have been using a form of public intimidation to enforce the very scale which they have been " negotiating," can the employers be blamed for their frigid reception of the new agreement? It was for this and other reasons that I referred to a suggestion which Mr. Parker has ignored, *i.e.*, " the reconstructed A.M.E.E."

It is not easy for any of us to listen to our critics in patience, but it is very dangerous to ignore or refuse to consider criticism, particularly if it is constructive. To my mind, this is what the A.M.E.E. have done consistently (even against the wishes and advice of the E.P.E.A.), and until they are prepared to at least consider the growing criticism against them—which I can assure Mr. Parker is far more extensive than he appears to be willing to believe—their work will continue to be without real success.

The accusations which Mr. Parker makes against me and others is unworthy of him. I had not intended to reply to his specific points and accusations, but I feel compelled to state that I have good reason for saying that it is not correct that 90 per cent. of even the local authority chief engineers are members of the A.M.E.E. The correct figure is 56 per cent. and considering the chief engineers of all authorised electricity undertakings (company and municipal), the A.M.E.E. has a membership of only 30 per cent. of the chief electrical engineers of this country. These percentages are derived from the actual statement of the A.M.E.E. to Alderman Walker at the Leeds meeting, and since they are recorded and minuted, seem to me to be incontrovertible. I have yet to find which of the statements of Mr. Parker's critics are incorrect, as he alleges. I also cannot resist the temptation to ask Mr. Parker, in view of the remarks at the end of the third paragraph of his letter, whether more, or less, than 25 per cent. of the members of the A.M.E.E. who were present at York on June 25th last to finally negotiate the agreement, are actually in appointments which were blacklisted, or have applied at some time or other for blacklisted appointments. I make the figure 25 per cent.

I am sorry that Mr. Parker should consider my letters to be venomous. I certainly have had no intention to be venomous, or to let my actions be governed by any self-interest. If such motives have impelled me, I offer my apologies but, upon examination, I still feel that my purpose has been disinterested and sincerely actuated by what I feel to be the real interest of present, and particularly of future, chief electrical engineers.

Norwich. J. A. SUMNER,
City Electrical Engineer.

E.A.W. Autumn Programme

THE Electrical Association for Women has arranged a number of meetings for the autumn. The first is on September 2nd and takes the form of a social afternoon, during which Miss A. W. Watters will talk on " Hospital Housekeeping in Wartime," and recitations will be given by Mrs. Adele Rose. On September 16th there will be a talk on " Local Government " by Councillor Mrs. Messenger, J.P., and other subjects are as follows: October 7th, " Building," by Mr. F. J. Osborn; October 22nd, cooking demonstration by Dr. H. Auspitz; November 4th, " Education," by Miss Agnes Catnach, B.A.; November 19th, whist and bridge drive (tickets 1s. 6d., non-members 2s.); December 2nd, " Health," by Miss Norah March, B.Sc.; and December 10th, kitchen talk, by Mrs. P. Mackay.

If possible refreshments will be served at a moderate charge at these meetings, which (with the exception of the last, which is in the E.A.W. Housecraft School) will be held in the Club-room. Tickets for the four talks cost 2s. (3s. for non-members) and for a single talk 9d.

Film Studio Installation

Interesting A.S.E.E. Lecture

WITHOUT the aid of electricity the art and practice of cinematography could hardly have progressed beyond the interesting toy stage, said Mr. F. V. Hauser in an illustrated lecture to the Association of Supervising Electrical Engineers in London this week. The lecturer is chief engineer of two studio groups at Denham (Uxbridge, Middlesex) and Pinewood (Iver, Bucks.) comprising twelve stages with a plant capacity of 7,000 kW.

Confining his detailed description to the Pinewood installation, Mr. Hauser explained that the maximum demand for studio photographic purposes approximated to 2,000 kW, or 1 kW per 30 sq. ft. of studio area. As DC at low voltage was necessary for arc lighting, five English Electric Diesel generators totalling 2,360 kW had been installed with three-wire distribution at 230/115 V for studio lighting and at 230 V only for all other purposes.

Electricity Cost Comparison

The choice was based on relative costs, since energy purchased on a two-part tariff would have operated harshly in the case of a studio in which restriction of the maximum load was impracticable. The outlay that would have been necessary on bulk high-voltage feeders was another influencing factor. The decision was correct, for tabulated operating data showed an annual saving of £4,000 in running cost and an overall saving of £1,500 yearly, in addition to a contribution of 33 per cent. to the heating requirements from the recovery of waste heat. Service had been satisfactory, maintenance being reasonably normal and the rate of liner wear much below the average for this class of engine.

To reduce noise and vibration, the engine foundations were formed of single island rafts of concrete 2 ft. thick set 9 ft. below floor level, and covered with a 2.5 in. sandwich of "Coresil" cork on which rested a common concrete block 7 ft. deep, the whole weighing 1,000 tons. The insulating air space round the foundation was 9 in. wide.

To minimise voltage ripple (hum) interfering with sound recording the generators had graded air gaps, specially shaped pole faces and skewed armature slots, so avoiding the expense of heavy smoothing chokes in main feeders and individual arc lamp circuits.

The poor station load factor was imposed by intermittent, sudden, extreme, fluctuations of studio demand, which approximated to 20,000 A at 115 V, though load coincidence was of brief duration. The cylinder jackets of all engines were kept warm by continuous circulation of hot water from the waste heat plant, so that an extra engine could be put into service in two minutes if required.

The average annual heat requirement was 280,000 therms, water being the medium, obtained under thermostatic control from the engine cylinder jackets, thimble tube exhaust boilers, two locomotive boilers automatically stoked, a refuse incinerator boiler and a 6,000 gal. thermal storage tank fitted with 450 kW of electric immersion heaters, which served as a common receptacle for all sources in addition to its real function of preventing rapid fluctuation of temperature. This closed system of softened water served 630 radiators, 20 calorifiers and the studio plenum warming system, aided by motor-driven circulating pumps.

On a cost per therm basis the immersion heaters could not have been justified, yet they were economic for load equalisation. With fuel oil of a calorific value of 18,500 BThU the overall thermal efficiency had risen to 64.1 per cent. In two years the utilisation of waste heat had reduced coal consumption by 761 tons, of a cash value of £1,150.

Distribution Arrangements

After describing the balancing control of the several sources of heat, Mr. Hauser turned to the studio switchboards (four 3,000-A and three 5,000-A panels) and distribution features, which he said included bare aluminium ring mains (19,500 ft. weighing 33.75 tons) supported by "Sindanyo" racks attached to the roof steelwork, descending in sheet-steel conduit to distribution boards at floor level, which were equipped with audible and visual signals for the overhead distribution "grid" attendants on gangways above. The object was to keep the floor free from trailing cables and feeding points, lighting equipment being stored overhead in the "grid" for quick lowering. Some 15,000 A at 115 V was needed for one stage, 10,000 A for two others and 6,000 A for each of two smaller ones.

The lamps employed included incandescent bulbs up to 5 kW each and arcs of up to 150 A, the Pinewood lighting equipment totalling 1,084 units of capacities ranging from 5 to 300 A. Intensities employed differed enormously, an average for colour photography being 1,500 ft.-candles, produced by 230 lamps needing 17,800 A at 115 V.

Ventilating plant and much other electrically operated equipment mentioned included reference to the way in which master control was exercised within the studio from a mobile desk on castors plug-connected by a 50-line multiple cable.

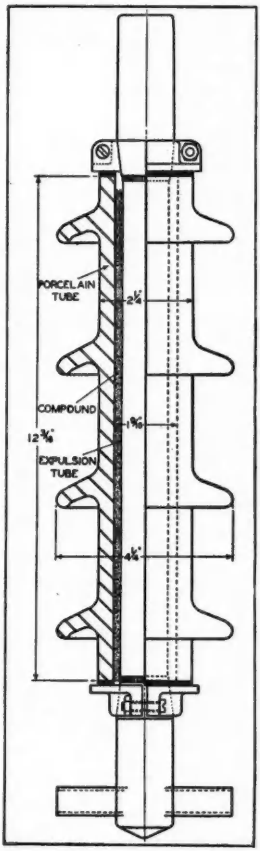
Surge Phenomena

An Account of Seven Years' Research Work

THE volume bearing the above title published by the British Electrical and Allied Industries Research Association (426 pages; 445 figs.) is a symposium of the E.R.A. reports issued during the years 1933-1940 on the work on surge phenomena which has been financed by the Central Electricity Board. The information contained in the book has, for the most part, previously been available in E.R.A. reports, and some of the work has been published, or is in course of publication, by the I.E.E. It is, however, useful to have all this information conveniently accessible in a single volume. The only other similar compilation is the A.I.E.E. "Lightning Reference Book," which has a somewhat wider scope and is a volume of no less than 1,524 pages.

The E.R.A. book is divided into 25 chapters, and each chapter corresponds roughly to an E.R.A. report. In addition, the chapters have been logically grouped under five headings, namely, the Study of Lightning, Surge Propagation, Surge Voltage Distribution in Transformers, Effect of Surges on Insulation, and Protection against Surges. The book combines the results of research work carried out in the library, in the laboratory, and in the field. A considerable proportion of the laboratory work has been done at the National Physical Laboratory, and six chapters have been contributed by the staff of the N.P.L. High-Voltage Laboratory. These chapters are concerned with the testing of lightning arrestors, the impulse characteristics of cables, insulators, and insulating materials, and the surge impedance of tower footings.

Considering the subject matter of the book in more detail, Part I deals with the fundamental characteristics of lightning, and Chapter 1 on the nature of lightning is a good example of library research.



Expulsion gap with porcelain weather shield

The most important conclusion reached is probably that a mechanism is suggested for the lightning discharge, which requires cloud potentials of only 50,000 kV instead of a few million kV which had previously been thought necessary to produce the discharge.

This part of the book also gives the results of investigations with klydonographs and magnetic links. No klydonograms of direct lightning strokes to overhead lines have yet been obtained; it must be remembered, however, that statistics of service experience show that on a 33-kV line (the voltage used in the investigations) ten miles long, a direct lightning stroke only occurs on the average every two years. The probability of obtaining a record of a direct stroke in a short time is therefore small. Fifteen surges have been recorded in the course of thunderstorms, but the magnitude of these surges is only a few times normal line-to-earth voltage.

Switching surges have also been recorded, and in the conclusions on page 67, it is stated that switching surges are limited to twice normal voltage. While this applies to the records obtained in this particular investigation, it is an unsafe generalisation, and experience with rod gaps in this country has shown that switching may give rise to overvoltages of four or five times normal.

Chapter 4 deals with the measurement of lightning currents by magnetic links, and gives the results of field investigations by the E.R.A. Only two records have been obtained, the magnitude of the tower currents being approximately 30,000 A in both cases. A further record was obtained by the Central Electricity Board on the Thames Crossing in 1935, and in this case also the tower current had a value of 30,000 A. Recently a much larger number

of towers have been equipped with magnetic links and it is to be hoped that further data on the magnitude of lightning currents in this country will soon be obtained.

Part II describes surge propagation investigations made on a 33-kV double-circuit line, a 132-kV single-circuit line, and a 132-kV double-circuit line with two earth conductors. In the last case, the line was provided with two earth conductors for a distance of about one mile from the substation in order to provide more efficient shielding against direct strokes to the line conductors close to the substation. As would be expected, the results of the experimental investigations confirmed that the double earth conductor has little effect on attenuation or surge impedance.

Surge impedance of towers and tower footings is dealt with in Chapter 11. In the past, the DC resistance of the tower footing has been used when calculating the magnitude of lightning current necessary to give rise to back flashover when a direct stroke occurs to the tower. It has now been shown that the true surge impedance of the tower footing is not greater than the DC resistance so that this simple method is justified. On the other hand, the investigations show that a large steel tower may have a considerable inductance, with the result that back flashover can occur even with low footing resistance; this has occurred on a large river-crossing tower in this country.

Transformer Investigations

In Part III the results of theoretical and experimental investigations on the surge voltage distribution in transformers are given. It is rightly emphasised that reinforced end turn insulation without capacitance grading may reduce and not increase the surge strength of a transformer. The results obtained also confirm that the static end ring has a beneficial effect. Information on the actual surge strength of large high-voltage transformers is still inadequate, and further data are required in order to ensure that rational co-ordinating gap settings are being employed.

Part IV is concerned with the impulse characteristics of insulating materials, cables, and overhead line insulators. It is interesting and useful to note that, in round numbers, the impulse strength of paper-insulated cable is 1,000 kV crest per centimetre. In Chapter 18 some useful sparkover voltage/time-lag curves are given for 132 kV, 66 kV and 33 kV systems.

Part V describes investigations on protective devices such as lightning conductors, arrestors and absorbers. The information on lightning arrestors, particularly those of English manufacture, is still inadequate, and further data are required on current-carrying capacity, voltage drop across the arrestor when carrying heavy currents, and the impulse sparkover voltage of high-voltage arrestors.

Chapters 23 and 24 deal with the E.R.A. surge filter, which consists essentially of a voltage limiting device such as an expulsion gap, in conjunction with a choke coil and damping resistance. The theory of the filter is discussed in detail, and the laboratory tests carried out by the E.R.A. and the N.P.L. show that a satisfactory performance has been obtained. It is now necessary to develop a commercial model which will withstand the continuous service voltage, stresses due to short-circuit currents, and above all, outdoor weather conditions. It is hoped that this development will be completed in the near future and the object of the E.R.A. achieved, namely, " to devise apparatus capable of being manufactured at low cost and giving a performance at least equal to that of available types."

Protection of Overhead Lines

Recommendations for the protection of overhead lines against lightning are given in Chapter 5, and it appears that, for this country, where the number of breakdowns due to lightning is not high, the comparatively cheap expulsion gap provides the best solution. As mentioned in this chapter, trouble has been experienced due to the external flashover of expulsion gaps under humid weather conditions, and the Central Board is now, as an experimental measure, installing a number of gaps which have been provided with porcelain weather shields, as shown in the diagram on the previous page.

The book is very well produced, and is printed on art paper—a luxury at the present time. It would have been an improvement if the subject-matter had been rather more condensed; details of apparatus and introductory remarks which were permissible in the original reports are out of place in the book, and tend to obscure more important matters. Nevertheless, the book will be invaluable for reference purposes, and should assist in dissipating the many misconceptions common in the realm of " surge phenomena."—J. S. F.

Swedish Power Schemes

THE Swedish concern, Krängede Aktiebolaget, founded by the Municipality of Stockholm in collaboration with a number of big industrial companies, is extending the large hydro-electric power station on the Krängede rapids of the Indalsälven River. There are at present three sets of turbines and generators totalling 150,000 HP, and a fourth 50,000-HP set will now be constructed at the station, which has its plant built entirely in the mountainside so that little is seen from outside.

At the same time the company is planning the construction of a new power station on a series of rapids called Gammelängsforsen and situated somewhat farther down the same river. This new station, the construction of which it is estimated will take some three years, will at first be of 55,000 HP.—*Reuter's Trade Service.*

Domestic Consumption *in* Wartime

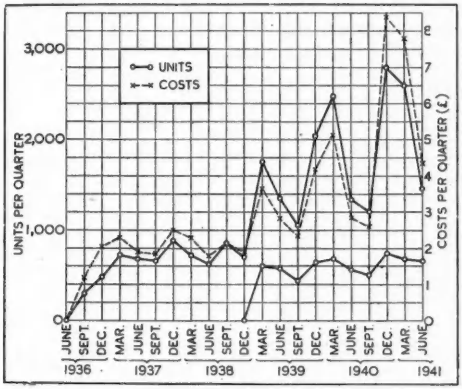
A Review of a Typical Installation

By
G. V. Harrap,
A.M.I.E.E.

IN the past, a number of articles have appeared in the ELECTRICAL REVIEW dealing with both general and individual domestic consumption. The former have for the most part been concerned with general statistics, while the latter have confined themselves to a detailed account of one year's running, taking into consideration other forms of fuel used, and ending with a determination of the annual cost.

Now that rationing of electricity has been mentioned, it is natural to ask, not what is the actual consumption, but what is the normal growth in consumption and what effects have war conditions had upon such growth. Also, how hardly will a compulsory curtailment of consumption affect consumers? This article is an attempt to answer this for a typical middle-class house, using electricity on all essential services.

A record of consumption has been kept over the last five years, during the middle of which a removal was made to a larger house. The kWh used and costs in each quarter are shown in the accompanying graph. The costs consist of the standing charge, the running and the hire charges for any electricity-consuming apparatus not owned. In the later period a segregation of kWh has been made to show the steadiness of one type of load.



Consumption and cost curves

It will be seen that the consumption has progressively increased, and this is especially noticeable during the period covered by the war. If a satisfactory explanation can be found, it might give a clue to the reason why so many undertakings have not lost load at the same rate as they have lost domestic consumers.

Initially, the installation was in a small semi-detached house in a provincial town, and the point for March, 1939, shows the result of moving into larger accommodation, with more electrical equipment, in a London borough. The larger electricity consumption during the first three quarters of this year is partly accounted for by the fact that all water heating is now carried out by a 12-gal. electric heater in place of the back-of-the-grate boiler installed in the first house. It is of interest to note how consistent is the consumption of this apparatus with normal use.

The consumption shown in the first part of the curve is typical of such an installation as is described above, and although the figure is a little higher than the national average, yet its variations are what are known to occur. The new feature in consumption is to be found in the latter part of the curves for kWh used and cost.

Consumption for the December quarter following the outbreak of war in September, 1939, rose to a new high point, probably through following the advice of E.L.M.A. to keep a high standard of illumination during the black-out, coupled with the rationing of coal bringing electric radiators into greater use.

In the March, 1940, quarter, the consumption increased still further, and this is an evident reflection of the intensely cold weather we experienced during the first two months of that year. The next two quarters show the fall to be expected in the better weather, longer days, etc., but consumption is a little higher than in the previous year, possibly owing to one or two air-raids calling for additional use of light and heat in the shelter.

At the beginning of last September the air-raids were getting fast and furious, but additional electricity consumption was not

shown until the December quarter. The kWh used now reached 2,800 per quarter, but coal consumption fell by about a third, since practically no evenings were spent in the house.

Heating was used much more too, and a certain amount of lighting was running all night through. During the March quarter, 1941, conditions were very similar. By the end of June, 1941, consumption had dropped to a more normal figure even though the kWh taken by the water-heater was practically the same as in the December, 1940, and March, 1941, quarters.

The outstanding feature of the graph is undoubtedly the progressive rise in consumption resulting from apparatus being gradually added, almost without being noticed at the time, but which has a considerable effect over a period.

Examination of the cost curve shows the truth of the saying " the more you use, the cheaper it gets," for in the early period when consumption was relatively small, this curve is always above that for kWh used. Later on, the curve falls below that for kWh used, and a quick calculation will show that while the total cost has increased, that per kWh has definitely decreased. In the last three quarters shown, the running charges were increased by 50 per cent. and the curve shows the effect of this.

But the most important feature of this investigation deals with the effect of the war, with its air-raids, black-out, etc., upon the consumption. It was proposed, just after the outbreak of war, that domestic consumption should be restricted to 75 per cent. of that prior to September, 1939. The curve shows how hard this would hit those who remain in badly " blitzed " areas. Actually, air-raids involve extra electrical equipment for installation in shelters, and restrictions on coal mean that people naturally turn to some other form of fuel to supply the deficiency.

Laboratory Furnaces

Commentary on Constructional Forms, Alternative Materials and Thermo-measurements

By P. Morris

WITH the increasing use of high temperatures in industry, such as in many metallurgical processes, the field for research at these elevated temperatures is becoming much greater. First, it may be as well to decide what is the dividing line between low and high temperatures. It may be defined as 500 deg. C. (950 deg. F.) or the temperature at which radiation from the hot object concerned begins to be just barely visible.

One of the many problems in high-temperature research which electrical engineers are helping to solve is uniformity. Consider, for example, a simple laboratory electric furnace of cylindrical form, 1 ft. in diameter and 2 ft. long, with a 2-in. tube on the axis heated so that its middle point is at 1,500 deg. C. If the sides and ends are at 200 deg. C. then the average radial gradient in such a furnace will be 260 deg. C. per inch, and the average axial gradient 108 deg. C. per inch. There will be gradients smaller than this within the middle part of the tube; nevertheless, with such large gradients in close proximity only the eye of faith can see within such a furnace any space of appreciable size which is uniform in temperature within 1 deg. C. Much otherwise good research work has been invalidated because the investigator has failed to study his distribution of temperature.

These factors are being recognised in the most recent forms of electric-resistance furnace. Some use a fan made of oxidation-resistant alloy to stir the air inside the space in which steel articles are being heat-treated, thus combining the ease and certainty of control of electric heat with the uniformity obtainable only by stirring. This method has not been adopted to any considerable degree in small electric furnaces for research; when the uniformity desired is such that stirring is necessary, resort is generally had to a liquid bath, either of metal or a fused-salt mixture.

The wire-wound electric-resistance furnace continues to be the most convenient and most easily made for the laboratory. For temperatures above 1,100 deg. C. the platinum-group metals are the only available materials for work in an oxidising atmosphere, and platinum-rhodium alloys are now being increasingly used in place of pure platinum. It is said that the volatilisation of the wire at 1,500 deg. C. and higher, due to oxidation and re-deposition of the metal, is less with the platinum-rhodium alloys than with pure platinum. There is a gain in the fusion limit and in the fact that the alloy is of a lower density, and so less weight is needed to furnish the same heat-dispensing surface as pure platinum. Alloys containing 10 to 20 per cent. rhodium are most generally used.

Platinum alloys for laboratory furnaces must be completely free from iridium, which is very volatile in the presence of air and has a way of depositing on the thermocouple which is being used to measure the temperature,

so rendering its readings several degrees too low, and this contamination continues progressively. In this respect vigilance is just as necessary now as it was 20 years ago, because platinum which has been especially purified to free it from iridium is a very special product which the manufacturer is not always likely to have in stock. Platinum or platinrhodium of thermocouple quality is equally satisfactory, but is needlessly expensive when the removal of iridium is the only essential specification.

Types of Resistor

The good thermal conductivity of thin alundum tubes did away with the old objection to winding on the outside of a refractory, but poorly-conducting, porcelain tube. Certain advantages of the inside-wound type are still recognised, as in recent zirconia-tungsten furnaces. A new design, consisting of zigzags made by welding alternate ends of rods laid parallel to the furnace axis, has also been introduced. Resistors in the form of tubes or rods, as well as granular, continue to be used. The tubular type is usually metallic (for instance, tungsten and molybdenum in vacuum, or hydrogen) and the granular material is a carbon or graphite mixture.

A recent development in rod resistors is a carborundum mixture capable of conducting a current between metallic electrodes when cold, and of withstanding oxidation up to 1,400 deg. C. It is being used in a great variety of furnaces because of its large power consumption and consequent rapid heating, but the uniformity of temperature is likely to be poor because the heat is radiated from a small area of resistor. No important recent improvements are to be noted in furnaces using carbon or graphite tubes, plates, and helices.

The familiar industrial use of a liquid salt, oxide, or metal bath as the resistor has not been introduced into the laboratory, although the great uniformity obtainable in a stirred bath is a strong recommendation for this method of heating.

Inductive Fields

One of the most useful developments has been high-frequency induction heating by the production of an alternating electro-magnetic field in which is placed the object to be heated, which must be an electrical conductor. The eddy currents induced in the object raise its temperature, the only limit being the vaporisation of the material that is being heated.

When the material is a liquid metal, the uniformity of temperature is almost perfect, because the liquid is electro-magnetically stirred at the same time that it is being heated. Fairly good uniformity in air or in vacuum is secured when the heater is tubular or of cylindrical crucible shape, especially if it does not extend beyond the ends of the furnace coil carrying the high-frequency AC. The poorest uniformity is obtained when the conductor being heated is a solid object of relatively low thermal conductivity.

The field has been produced in three different ways. The earliest was by the use of a mercury arc with condensers in parallel, which is not a tool of precision because the arc constantly fluctuates. In the substitution of a rotary convertor the difficulties are mechanical, since a frequency of a few thousand cycles is useful only for heating large objects or melting large tonnages. For small objects, as is usually the case in laboratory research, a low-frequency circuit simply does not deliver enough power into the conductor to heat it successfully.

With electron tubes very high frequencies can be delivered, while at the same time the system offers a wide range of control with dependable constancy. The costs of experimental and original development work make the apparatus still quite expensive, but soon it will be a necessary part of most research laboratories.

The electric arc in the laboratory is still very much what it was in the days of Siemens and of Moissan, the most convenient source of very high temperatures and the least subject to easy control and uniformity. Physicists and chemists have therefore avoided it, and it has been used mainly for metallurgical reduction of material of high melting point, without necessarily knowing the temperature. The recently proposed use of a focusing mirror with the arc promises better control. Most of the intense radiant energy could thus be transferred, away from the source and the chemical complications that accompany work in the arc itself, avoiding the large loss that results from undirected radiation.

Means of Measurement

Temperature may be measured in three ways: by touch, by feeling without touching, and by seeing. In the touch methods, the pyrometer is in contact with the hot object and assumes its temperature. This type includes the electric-resistance thermometer and the thermo-electric pyrometer. The method of feeling without touching is typified by the radiation pyrometer. The method of seeing makes use of the optical and the colour pyrometers.

The electric-resistance thermometer is seldom used above 1,000 deg. C., and not widely below 500 deg. C. where no question can arise regarding changes in the resistance or damage to any accessory apparatus or connections. It is not a good thermometer with which to explore uniformity, since it integrates over an appreciable volume.

For measurements from 500 to 1,500 deg. C., and particularly for exploration for uniformity, the thermo-electric pyrometer is the most useful. Its adaptability has been greatly widened by the adoption of nickel alloys for the thermocouple wires. In the early days the field was divided between the copper-constantan or iron-constantan couple for the lower

temperatures, and the platinum-platinrhodium for the higher. The introduction of the nickel alloys immediately extended the field of the base-metal thermocouple to 1,100 deg. C., whereas it had formerly been restricted to temperatures at which copper or iron would not oxidise.

But the use of two alloy wires, in place of one alloy against a pure metal, has multiplied by two the troubles due to inhomogeneity and lack of reproducibility. In spite of improvements by the manufacturers, all of the base-metal alloys are still more variable than the pyrometrist can permanently permit them to be. Further metallurgical study is needed, with two objectives: making the electromotive force reproducible within 0.1 per cent., and making the wire so homogeneous that temperature gradients of 20 deg. C. or more per foot of length will not cause stray electromotive forces.

A tungsten-graphite thermocouple for temperatures beyond the reach of the platinum-platinrhodium couple has been in course of development as an industrial instrument, but is not yet available in a form suitable for the research laboratory.

Automatic Recording and Controlling

There have been very considerable advances in automatic recording and controlling with the aid of the thermo-electric pyrometer. The earliest were nothing more than recording millivoltmeters. The pointer of the galvanometer or voltmeter carried a pen which made a series of dots when periodically pressed against either a circular chart or a strip of paper. While this type of instrument is still in very wide use, it is being replaced in a number of applications by the automatic potentiometer.

Apparently industrial users are sensing a fact which the physicist has always known, namely that the potentiometric method is more accurate and also more dependable than the millivoltmeter for reading the electromotive force of a couple. In effect, it replaces a deflection method of measurement by a null method, eliminating the errors and uncertainties of reading a deflection by transferring them to another part of the system where they can be better controlled.

The readings of the potentiometric recorder are necessarily discontinuous because the galvanometer must be given time to swing free and thereby show whether the setting is at balance or has departed therefrom. The period of discontinuity has been gradually lowered to less than two seconds.

There are few radically new instruments for the measurement of temperature by means of the total radiated energy. Progress during the past decade has been in the direction, first, of a more constant and reproducible thermopile receiver for the energy and, secondly, of a shorter period of response. An interesting proposal is to cause the deflection to be produced by the change in magnetic susceptibility of a nickel alloy rather than by a thermal electromotive force.

The radiation pyrometer has never been well adapted to the study of uniformity; first, because it integrates the effect of an area which is larger the greater the distance; and, secondly, because its period of response is seldom less than 6 or 8 seconds.

Optical Pyrometry

For most conditions when the temperature is above 1,400 deg. C., and for all when it is above the melting point of platinum (1,774 deg. C. according to the most recent measurements) the disappearing-filament optical pyrometer has never been exceeded in precision and not often in accuracy. Its most available forms have never been entirely satisfactory as optical instruments.

The eye is so extremely sensitive to differences of brightness that it can match a lamp filament against a bright background, when the light is monochromatic, with a sensitivity such that even the slight difference due to diffraction around the edges of the lamp filament is easily detected. Therefore an important step was made in the progress of optical pyrometry when it was shown how the optical system could be improved with the aid of diaphragms and good lenses so that the disappearance of the filament was absolutely perfect.

Although the optical method is extremely precise, it still has the disadvantage of being a subjective measurement. An observer's eye and brain must always judge the matching of brightness, and several seconds are necessary for the making of this judgment. The instrument has therefore never been adaptable to continuous recording or controlling of temperature.

Use of Photo-electric Cells

Photo-electricity is a possible way out, but to substitute the electric eye for the human eye is not as simple as it might at first appear. It is still arguable whether the photo-electric cell can be depended on for the accurate measurement of the absolute brightness in all colours. It is the history of the millivoltmeter versus the potentiometer over again, with the difference that the photo-electric total-deflection instrument has never had any real foothold such as the millivoltmeter still has. It seems that for the most accurate work the photo-electric cell will have to be used as a null instrument, just as the galvanometer is used in the automatic potentiometer.

On this basis there seems to be a very good chance of the photo-electric cell becoming a substitute for the eye as a matching device; the function of the brain behind the optic nerve still remains to be worked out electrically and mechanically, though it seems certain that this can be done.

Static Electricity on Motor Vehicles

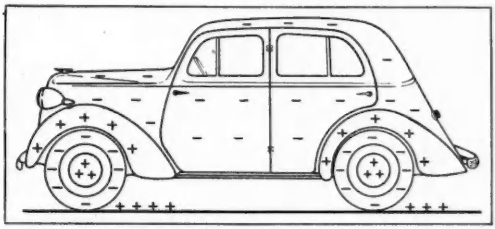
American tests show the extent and nature of charges at different speeds

By A. M. Spruce, A.M.I.E.E.

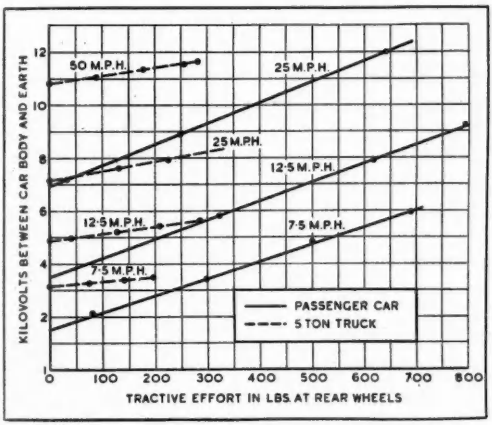
RESULTS of road tests made in the United States with a view to studying the risks of fire caused by the accumulation of static electricity on rubber-tyred vehicles carrying inflammable or explosive materials have recently been given in *Electrical Engineering*.

Values of voltage were first taken on cars as they came to a standstill at the toll booths at the Holland Tunnel in New York City and at the Marine Parkway Bridge in Brooklyn. The electrostatic instrument employed had various scales calibrated in volts up to 15,000. Its earth terminal was connected to an earthed stanchion, and its high-voltage terminal to a wire attached to a contact on a pole that was held against the bumpers of motor vehicles as they stopped at the toll. Buses and heavy petrol trucks gave the highest readings, approximately 5,000 V. The voltages were affected greatly by the high humidity of the summer season (when most of the readings were taken) by direct exposure to salt atmosphere, by hot tyres and by relatively low surface resistivity of the roadway.

A car was equipped as a travelling laboratory for static electricity tests. During dry cold weather, most meter indications were well off the 15,000-V scale and subsequently a 30,000-V scale was added. The voltage remained at its high value for the full duration of the stop of twenty minutes or more, sometimes with no apparent decrease, while at other times the indication would very gradually diminish, giving evidence that hours might be required for total discharge, depending upon the degree of dryness of the roadway. The use of a drag chain at the rear of petrol trucks made no measurable difference in the rate of decrease of the voltage.



Electrified vehicle showing normal distribution of charges with "wake" of positive charges in roadway



Voltage curves for passenger car and 5-ton truck, simulating the condition of ascending steeper and steeper grades at constant speed

In order to control some of the variable factors which influenced the voltage generated, tests were conducted on different types of vehicles by means of a high-speed chassis dynamometer. The rear wheels of the car rest upon and drive large drums on this device, which can operate a generator for applying any desired value of load on the car. Readings of the electrostatic voltage were taken from no load to heavy loads and at speeds up to seventy miles per hour.

Such variables as air currents, changes in humidity, and changing roadway conditions could be eliminated or controlled.

The drums upon which the rear driving wheels operate were earthed, and the voltmeter was connected between parts of the car body and earth. One test was made by loading the generator of the dynamometer, while the tractive effort at the treads of the rear wheels was increased in order to maintain a constant speed of drive. The effect of this loading on the generated voltage varied linearly with the tractive effort.

These tests were taken at four speeds for a passenger car and at three speeds for a 5-ton truck. As the tractive effort increases at the treads of the rear tyres, the rubber fabrics in tending to slip are forced closer into the interstices of the molecular surface structure of the drums, or roadway, with a resultant increase in the extent of the contacting surfaces and, therefore, in the proportionate voltage.

Materials which compose the modern highway, like rubber tyres, possess excellent insulating characteristics. The tyres, while rolling, acquire electrons and thereby become negatively charged. The positive atomic charges lie as " wakes " behind the wheels in the surface of the roadway, while the negative charges on the tyres have a strong influence in electrifying the car body.

The high negative electrification on the tyre treads repels to the more remote parts of the car body the free electrons in the metal nearest the tyres, such as the wheels and mudguards. This leaves high positive electrification on the adjacent metal parts as " bound " charges; the repelled electrons on the remainder of the metal parts of the car constitute " free " charges, which flow to earth if a path is provided for them.

NEW BOOKS

Identification of Molecular Spectra. By R. W. B. Pearce and A. G. Gaydon. Pp. 221; plates. Chapman & Hall, Ltd., 11, Henrietta Street, London, W.C.2. Price 42s.

The success with which the quantum theory has been applied to the case of band spectra has led to determinations of molecular constants such as moment of inertia, intra-molecular distances, and frequency of molecular vibration. Identification of spectra could then be attempted with this knowledge, but it was tedious and required considerable experience. Such identification is important in many fields. In astrophysics, for example, CH, OH, MgH have been detected in sunspots, while in chemistry, certain stages of chemical reactions indicate the presence of groups such as CH, NH and OH which are only physically stable.

The object of the present book is to simplify considerably the procedure involved in identifying any of the commonly occurring band spectra. This is achieved from two directions :— (1) The strongest " band heads " of each molecule are recorded in tables in order of wavelength, as well as such useful information as origin, intensity and appearance ; (2) individual lists of band heads for each system of each molecule are given, together with occurrence, appearance, transitions involved and further references. Thus, the method of procedure consists in obtaining a clue from (1) the strongest band wavelength of the unknown system and then from (2) detailed information of other members.

Further help is given for direct comparison purposes by the inclusion of eight plates, six of which are spectra of most commonly occurring molecules, while the last two give comparison spectra of iron, copper, mercury, neon and the standard iron arc. There is also a well-written section of practical hints at the end which would have been better placed at the beginning. The book concludes with a list of the most persistent line spectra wavelengths.

The authors in presenting these tables are to be congratulated on producing a noteworthy piece of work. From the care they have exercised in their compilation, as well as the devoted labour bestowed on checking and extending the results of other workers, they have produced a reliable and helpful book of reference.—L.J.

Technology for Sugar Refinery Workers. By Oliver Lyle. Pp. 401; figs. 93. Chapman & Hall, Ltd. Price 15s.

This book is written in a very interesting and generally non-technical style, enabling the complex and technical subject to be clearly understood by foremen and operators. Although frequent reference is made to the Plaistow refinery this in no way detracts from the usefulness of the book, as much of the subject-matter applies to the sugar industry generally.

The chapters on the generation and use of electricity are well illustrated by diagrams, and should be of assistance to the operator in understanding the " mysteries " of the electric motor, at the same time proving useful to the engineer and electrician.

Chemistry and sugar analysis are dealt with in such a manner as to make understandable to the average operator a very important side of the industry, which in most textbooks is made very technical and written for experienced chemists.

Though well set out the chapter on steam generators and boilers might have been improved had more been written on the heat balance in a sugar factory. The author describes the working of centrifugal pumps in an original manner, and gives much useful information. A comparison is made of the various classes of pumps and their duties, also some of the troubles experienced.

Each set of diagrams is separately described at length and the author in a foreword states that they were added after the completion of the general subject-matter. They thus serve as a double description of many important points.

Sections on recovery, losses, savings, control, and commercial matters, explain much that is useful and will be readily appreciated. The book should prove a welcome addition to any library on the subject and most useful to operators who are desirous of improving their knowledge, so making their work more interesting.—A.G.B.

Prospects in Canada

Why British Firms Lose Business

By E. Arthur Pinto, A.M.I.E.E., M.E.I.C.

DUTIES which recently brought me to Canada have also afforded me an opportunity for frequent contact with many classes of Canadian and American electrical engineers. It is thought that some of the impressions gathered in the course of this association may prove of interest and also throw a sidelight on conditions in these countries as regards the possible openings for British manufacturers in post-war trade. It is desired to point out that during this visit I have not been engaged in any commercial sense, so that opinions expressed to me by trans-atlantic engineers are perhaps the more reliable and unprejudiced.

The author has been in Canada since January last as the electrical member of the United Kingdom Technical Commission (Ministry of Supply). He has recently been elected a member of the Engineering Institute of Canada

There can be no doubt that Canada forms one of the most potential fields for an increase of trade with Gt. Britain. The war has brought about an enormous growth in the Dominion's manufacturing resources and though at first glance this might be held to constitute a form of added competition with U.K. manufacturers, it is none the less a fact that even with her greater manufacturing facilities Canada is by no means self-supporting in this respect. Increased production necessitates increased equipment and it is particularly in this direction that British engineers, with their long and varied experience of manufacturing methods for almost every industry, should be able to reap a rich harvest if they will but make the necessary effort and will show themselves to be adaptable to local requirements.

After the War

There has been a considerable influx of British engineers and technicians due to wartime developments, and it is fairly certain that these will have unconsciously smoothed the path for those who will follow after the war even if only through their conversations about English methods, a subject on which Canadians are always eager to become better informed. For Canadians have an unshakeable confidence in the future of this great Dominion. Various reasons have contributed to the fact that Canada has a population of only about 12 million, but this low figure must rapidly rise, thus opening still further markets for trade expansion.

With a few outstanding exceptions, U.K. electrical manufacturers have up to the present obtained a woefully poor footing in the Canadian markets. This may to some extent be due to the existence of "non-aggression pacts" between manufacturers on both sides of the Atlantic, either individually or through federations, but if such is the case the result has undoubtedly been to the disadvantage of British trade. It will be understandable, however, that it is not easy to obtain definite information as to the existence or otherwise of such "pacts" because on this side the participants in trusts or the like are not anxious to have their trade-controlling interests brought into the limelight of public opinion. This is a matter on which official investigation might well be focused by those whose position entitles them to do so.

Let us now examine the conditions which are prejudicial to an extension of our trade with this great Dominion. Probably 80 per cent. of the electrical goods which are imported into Canada are of United States origin; 10 per cent. are British; and the remaining 10 per cent. from other sources.

Willing to Buy

There is certainly no prejudice against British goods. The exact contrary is the case, but the first contractor whom the writer questioned on this point—a leading Montreal man—said, "I'd be tickled to death if I could use more British goods—in fact, all my goods which are not of Canadian manufacture—but your British manufacturers just won't let me." This opinion has been the keynote of almost every conversation on this topic and it therefore behoves us to inquire into the matter. We have, *prima facie*, a willing buyer and, we hope, a willing seller. Why do they not get together?

In view of the vast preponderance of goods imported from the U.S.A. as compared with those from all other countries, it will suffice, for the purposes of these articles, to consider only the competition from that source. The American manufacturer starts off with a big disadvantage in that his goods are subject to a considerably higher import duty than are those from the Mother Country. On most of the more important lines the preference is as

much as 10 per cent., typical figures being 25 per cent. against American products and only 15 per cent. on British goods. These figures are for complete electrical appliances and also for dynamos, etc. The British manufacturer at once proceeds to nullify this initial advantage (a) by his poor "salesmanship" and (b) by his lack of adaptability and his failure to appreciate that the requirements of his would-be customer are not necessarily in all respects the same as those of his market at home.

American Salesmanship

"Salesmanship" does not, in America, imply merely the sending of a representative, technical or otherwise, or the posting of catalogues and quotations. Nor does it mean loud sales-talk or decrying one's competitor. In fact, the good salesman in America, equally with the good manufacturer or dealer, quickly disabuses one of any idea that he is trying to "put over a hot deal." It is recognised that this does not tally with the usual British conception of the American salesman, but it is none the less true. His motto is "service" in its widest sense, meaning a wish to be helpful in every possible direction.

I recently experienced a typical example of such methods. The goods in question consisted of a particular type of switchgear which is non-standard in this country. In England there are several makers of these goods, so those who are represented here were all approached, but no information was available. A New York firm of manufacturers then offered to adapt their standard gear to the new requirements. They were asked to send details of their proposals. To my amazement, by 11 a.m. next day two engineers arrived by aeroplane in Montreal, armed with detailed drawings in triplicate and these men were fully able to discuss and further amend the proposals wherever required.

Unsuitable Representatives

An important matter is the question of the men themselves who represent British manufacturers. In many cases, even with the best firms, they have appointed merely "agents" or "jobbers" who know nothing of the firms they represent or the goods they sell, and who often carry a competing American line to fall back on or, under suitable circumstances or for a better commission, even to push in preference to the British goods. Even all this would not be so bad if the agents selected were suitable men. Unfortunately, too many British firms are represented by the worst type of agent, men who are known here as "patent jumpers."

An architect told of a case where he specified a large number of electric heating units of a very well-known English make. By some means the agent managed to substitute for the all-important heater portion an altogether inferior local product, with the result that the whole had to be condemned. This particular manufacturer had had three different Canadian agents in 12 months, each, according to this architect, worse than the one before. His trade in Canada is likely to suffer a serious setback.

There is yet a further type of salesmanship adopted by British firms which greatly annoys Canadian buyers, *i.e.*, the attitude of approaching a subject with, in effect if not in words, "What is good enough for England is good enough for Canada." This is a very sore point and has undoubtedly lost Great Britain a lot of business, the salesmen who adopt this attitude entirely losing sight of the fact that it is not a question of an article being "good enough" for Canada but that the only criterion on which the Canadian buyer can base his judgment is whether the goods are suitable for Canadian conditions. Illustrations of the importance of this point will be indicated when possible openings for British manufacturers are being considered.

Lack of Competitive Spirit

Allied with this attitude of "take it or leave it" is the equally disconcerting one of indicating or implying an inferiority complex as regards British manufactures. I brought to Canada a certain piece of domestic apparatus which I found was not suitable for operation under Canadian supply conditions. The makers are a very well-known English firm with a world-wide reputation and they are well represented in Canada with their own staff and offices. To an inquiry as to whether they could adapt this apparatus for local use, the Canadian branch replied that they knew nothing about this article as they could not handle it here owing to American competition. Yet this is a line with an enormous sale both in Great Britain and in Canada, but the English firm had given up the fight in this direction after a very feeble struggle.

Domestic Appliances

In connection with domestic appliances, it is a rare event to see, in either high-class or cheap stores, any examples of English goods whatever. Yet this is probably the direction in which American practice approaches most nearly to the British; in fact, most English articles such as irons, kettles, toasters and the like are suitable for the Canadian market with practically no modification. For all such goods there is a ready market. There are, however, many other classes of British goods which might be placed in Canada. Some will require a certain amount of adaptation, but seldom will this present any insuperable obstacles.

In a later article I hope to indicate where British methods have failed in the past and to deal with possible openings in various branches of the industry.

The Higher-Voltage Trend

Its Bearing on Transmission, Distribution and Utilisation

By C. J. O. Garrard, M.Sc., A.M.I.E.E.

DURING the war the extension and development of electricity supply is bound to be confined to the needs of war production. Existing plant must be used to the best advantage and unessential services drastically limited. After the war the rebuilding of our towns, the establishment on a firm basis of a revived countryside, and the possibility of applying our energies to the general welfare must lead to a large increase in the generation, use, and therefore transmission of electricity. More electricity will be transmitted over greater distances.

Gains in the electrical and economic efficiency of the transmission of both small and large amounts of power are likely to be brought about only by continued increases of operating voltage, that is, by advances in the technique of insulation.

An extension of the use of high voltages in circumstances where low and medium voltages have been generally applied is to be expected after the war. This, while bringing advantages, will present technical problems which will have to be solved as they arise

Improvements in conductors seem to be ruled out by the physical properties of the available elements. Electrolytic copper is already the best of the known conductors but one, namely silver, which is not sufficiently plentiful for general use, and in any case only 10 per cent. better than copper. The possibilities of improvement in insulating materials are, on the other hand, very great.

In the early stages of the art, when oil-impregnated paper and porcelain had replaced the silk ribbon and gutta-percha of the pioneers, the problem was mainly to prevent puncture of insulation by direct voltage breakdown. Now the emphasis lies more on preventing thermal instability caused by dielectric losses and progressive deterioration arising from ionisation in voids.

The attack upon the former problem is being greatly aided by the rapid advances in the chemistry of plastics. It is now possible to forecast from their chemical and molecular constitution the dielectric properties of many substances. The result will probably be the production of impregnating compounds with losses in order of magnitude less than those of the materials at present in use (phenol and urea compounds, oils, etc.). The polystyrene compounds already in limited use for making condenser bushings are a case in point.

The conception of the British grid, as its name implies, differs fundamentally from that of some of the long-distance power transmission systems in operation abroad (Boulder Dam, Rhenish-Westphalian-Swiss line and so on). It was designed, as a national busbar, to increase the availability of, and improve the distribution of, load between groups of generating plant, each in fairly close proximity to a particular block of load.

Transmitting Large Blocks of Power

For this purpose the grid has been an unqualified success; in the present emergency we have reason to be grateful to those who planned and brought it to reality. However, as it is a close network of interconnected lines, the grid is not so suitable for the transmission of large blocks of power over long distances, which will become necessary as soon as the next great extension of national load takes place.

The sites in the British Isles at which it is possible to generate very large amounts of power are limited in number by the necessity of having coal and cooling water at hand. As there are no sufficiently large rivers or conveniently situated inland lakes, coastal stations erected on the north-east and north-west coasts, in South Wales and on Clydeside, appear to be the only solution; there are already great load centres in London and the Midlands, and the load is continually being dispersed more evenly over the country so that transmission lines 150 to 200 miles long will be required, capable of dealing with perhaps 250 to 500 MW.

The grid was designed for transmitting about 50 MW at 132 kV, or say 200 to 250 A per line. At 100 MW such lines would be overloaded both from the point of view of losses and inductive drop, as they would be operating above their natural load.

The natural load is that at which the reactive wattless power corresponding to the passage of the load current through the inductance of

the line is just balanced by the capacitative wattless power corresponding to the application of the system voltage to its electrostatic capacity. Unless a transmission line is operated at a voltage such that its natural load is nearly equal to the power to be transmitted, excessive costs are incurred for compensating for the surplus wattless power by means of synchronous machinery, reactors, condensers or the like.

In the case under consideration, namely the transmission of 250 to 500 MW, the most advantageous voltage would be 300 to 400 kV. Such a line could be designed to operate initially at 220 kV and be converted subsequently by reconnection of the transformers for service at 380 kV.

A Super-Grid

The modification of the grid to operate at voltages such as this would be impracticable. The correct solution would be to superimpose upon the grid a super-grid, consisting of relatively few very-high-voltage lines connecting the main sources of bulk power with the main centres of load. Interconnection of the generating sources should not be required, and in addition would be undesirable as unduly increasing the short-circuit currents.

While the economical use of such lines would make it necessary to run them at or about full load for a high proportion of their life there would nevertheless be times at which they would need to be run partly loaded, and reactive compensation would be required. For this purpose static reactors might well be used.

The advantages of running such reactors at very high saturation do not seem to be generally realised; if the iron is operated well above the knee of the saturation curve a comparatively small variation in the voltage at the reactor terminals results in a large variation of the current drawn from the lines. In fact, the reactor behaves in some respects like a machine which generates a more or less constant EMF, in contrast to an unsaturated reactor, the back EMF of which is proportional to the applied voltage.

The efficiency of such highly saturated reactors is very good, because as the saturation is increased, the wattless power per pound of iron increases much faster than the losses. Higher harmonics may be compensated for by suitable connection of the windings.

Distribution Problems

When one passes from the national to local distribution systems the problems are somewhat similar in kind if different in magnitude. The solution again lies in the development and expansion of the extra-high-voltage trunk systems that already are being superimposed upon the larger distribution systems.

As the increase in the amount of power to be transmitted will probably in any case lead to more general adoption of 132 kV for this purpose, the provision of new trunk feeders and interconnections may be considered as an extension of the grid, which will thus become denser in those parts of the country where demand is heavy. The growing difficulty of finding routes for overhead lines as well as æsthetic and other practical considerations will probably lead to greater use of 132-kV cables.

The technical problems of manufacturing and installing such cables may be said to have been solved, although certain difficulties will arise in compensating the very great capacity currents of large high-voltage cable systems particularly at times of light load. Such difficulties have, it is understood, already been encountered on certain 66-kV cable systems. The application of compensating reactors at points distributed over the network appears to be the solution, and again saturated reactors would appear very suitable.

The principle of carrying the high-voltage supply as near as possible to the point at which the energy is used applies throughout the whole scheme of distribution. In towns the point is soon reached when a further increase in the capacity of medium-voltage networks becomes economically unsound. The medium-voltage cables must then be joined into a solidly connected grid fed by a multiplicity of step-down transformers from a superimposed high-voltage network.

Need for Long-Range Planning

In order that the development of a network upon these lines may be pursued smoothly, it is essential to lay high-voltage mains at the same time as the medium-voltage conductors. Unless, however, long-range plans for the development of the town or city itself are in existence and are followed, costly mistakes are likely to arise. Here in a small instance is shown the importance of long-range and large-scale planning for post-war reconstruction. There is no room in this small and overcrowded country for guessing and haphazard expansion.

Where a sufficiently comprehensive high-voltage system is available the medium-voltage system may be relieved to some extent by supplying all buildings where the load is not less than say 20 to 30 kVA direct from the high-voltage system. This policy has been pursued in Paris for many years with somewhat primitive apparatus consisting of high-voltage fuses with disconnecting links. A more robust totally enclosed equipment need not be very expensive. A similar principle can with advantage be applied to large factories and works, each shop or building having its individual high-voltage supply.

An objection to this method that is sometimes heard is the alleged excessive cost of the necessary switchgear. Probably in many

cases too much money is spent on switchgear for industrial plants. Standby plant is of course essential, but unless continuity of supply is vital (as, for example, in chemical engineering or complicated mass-production processes) careful consideration should be given to whether completely automatic selective protection is necessary. If this is not so, then money may be saved by omitting circuit-breakers on the high-voltage side and clearing a fault by switching out several sections rather than one only.

It is true that on paper the expense of switchgear can often be justified by calculations of the output lost by, say, ten minutes' stoppage and so on; however, if the output depends at all upon the effort made by the workpeople such calculations may be fallacious, because they neglect the fact that workpeople will generally make up the time so lost by working a little harder afterwards. Where the processes in question require direct current, much advantage may be obtained by installing small rectifier substations near the load centres. The modern air-cooled steelclad pumpless mercury arc or metal rectifier is ideal for this purpose.

Rural Electrification

That rural electrification is an essential part of a successful land policy needs no argument. A boldly planned scheme must include extensive distribution at 6.6 or 11 kV backed up by the main interconnections at 33 or 66 kV.

The experience of countries such as Switzerland shows that with proper precautions lines at 11 kV present no more danger than at 440 V; in fact, for this purpose 11 kV is the less lethal voltage because by its use the likelihood of an earth fault persisting and producing dangerous voltages in the ground or on metal fences or the like is much reduced.

Utilisation at High Voltages

The main field for the extension of utilisation at high voltages must be for power and heating in industry. The present economic lower limits for winding high-voltage motors are: 2.2 kV, 50 HP; 3.3 kV, 100 HP; 6.6 kV, 200 HP.

As the technique of insulation improves, these limits will probably be reduced, although the relatively high cost of protective gear for small high-voltage motors is undoubtedly a hindrance. The small full-load currents make it difficult to obtain adequate over-current protection at all, having regard to the fact that current transformers for small primary currents cannot economically be made with a high over-current factor, *i.e.*, security against short-circuits.

The grouping of a number of motors on one breaker and the provision of warnings operated by thermal devices mounted in the individual motors may be a solution. Where individual over-current protection is necessary, a sufficient demand should produce a cheap and sensitive over-current relay that could be operated from current transformers of low output. An expedient is to use 1-A relays in conjunction with current transformers having 5-A secondary windings.

Electric furnaces and ovens are obvious cases for high-voltage supply; where buildings are electrically heated it may be preferable to use a high-voltage electrode boiler with hot water or steam radiators rather than a large number of individual electric radiators that must be supplied at medium voltage.

Power for Aluminium Production

TWO new generators are being added to the Chute-a-Caron power plant on the Saguenay River, near Arvida, Quebec, which is operated by Aluminum Power Company. They will increase the existing capacity of the plant by 100,000 HP to a total of 260,000 HP. The first of the new generators will be installed by December of this year and the second by the spring of 1942. Development at this point, it is understood, is capable of producing an ultimate capacity of approximately 1,250,000 HP.

Water for the new plant will be obtained from openings to be cut in the gravity section concrete wing wall of the main dam. The new units, operating under a head of 150 ft., will discharge into the existing tail-race. The generators will be moved to the new Saguenay development, now under construction, as soon as this is ready. The present purpose is to use quickly all available power so that aluminium production can go forward speedily to fill expanding war needs.

In the United States, utility systems, both private and public, are to construct interconnecting lines as part of the Federal Government's defence power expansion programme. By these interconnecting links, defence officials hope that power pools, mobilising reserves to meet armament needs, will permit accumulation of a million kilowatts of plant capacity, which would meet all the demands of aluminium production and most of the demands of magnesium production. Already one such pool is in operation in the eleven south-eastern States. The other two power pools in the south-west and the north-east will be similar in nature, but they may not involve the curtailment features necessary in the Tennessee Valley areas.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specifications (1*s. each*) *can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.*2.

1939

28417. "Protection of three-phase and poly-phase networks from disturbances caused by short-circuits due to arcing." Akt.-Ges. Brown Boveri & Cie. November 17th, 1938. (Addition to 522206.) (538265.)

30729. "Spark gap devices." Westinghouse Electric International Co. December 7th, 1938. (Cognate applications, 30730/39 and 30731/39.) (538269.)

32158. "Electrical integrating apparatus." Sangamo Weston, Ltd. July 15th, 1939. (538160.)

32453. "Automatic electric regulators." N. R. Davis, J. N. Wetherilt, and Sun-Vic Controls, Ltd. December 18th, 1939. (538118.)

32608. "Electric circuit-breakers." General Electric Co., Ltd., and F. J. Keeley. December 20th, 1939. (538228.)

1940

767. "Insulators for coaxial cables." Marconi's Wireless Telegraph Co., Ltd., and N. Wells. January 12th, 1940. (538119.)

1189. "Automatic telephone exchange and like switches, and multiplying arrangements therefor." Standard Telephones & Cables, Ltd. (O. J. J. Bracke and G. X. Lens). January 19th, 1940. (538122.)

1199. "Means for automatically maintaining the electrolyte level in electric storage batteries." C.A.V., Ltd., and S. Leeson. January 19th, 1940. (538124.)

1256. "Blocking-layer electrode systems, and methods for the manufacture thereof." Philips Lamps, Ltd. January 23rd, 1939. (538131.)

1362. "Hand generator electric torches, pocket lamps, and hand lamps or the like." W. J. Wood. January 23rd, 1940. (538134.)

1366. "Electrical condensers." A. C. Cossor, Ltd., and S. H. Lines. January 23rd, 1940. (538195.)

1384. "Process for the manufacture of frames for electric incandescent lamps with hard glass or quartz bulbs." Vereinigte Glühlampen und Elektrizitäts Akt.-Ges. February 20th, 1939. (538197.)

1385. "Electron-discharge apparatus." Standard Telephones & Cables, Ltd., and J. H. Fremlin. January 23rd, 1940. (538198.)

1409. "Electric motor control equipments." A. D. Ferguson and Metropolitan-Vickers Electrical Co., Ltd. January 23rd, 1940. (Cognate application, 7123/40.) (538200.)

1561. "Lighting fittings." F. G. Gillard and Plessey Co., Ltd. January 25th, 1940. (538283.)

1564. "Cotter pins for retaining suspension pins in insulator hoods." Bullers, Ltd., H. C. R. Dagnall, C. C. Cockbain and G. Perrins. January 25th, 1940. (Cognate application, 2410/41.) (538284.)

1700. "Lighting fittings." Simplex Electric Co., Ltd., P. W. Davis and H. S. Allpress. January 27th, 1940. (538136.)

2537. "Systems for the transmission of modulated radio-electric waves." Standard Telephones & Cables, Ltd. February 14th, 1939. (538206.)

2728. "Apparatus for measuring and recording dew points." Callender's Cable & Construction Co., Ltd., and A. Simons. February 13th, 1940. (538287.)

2789. "Fuse elements for the protection of electric circuits." Artic Fuse and Electrical Manufacturing Co., Ltd., and F. A. Ross. February 14th, 1940. (538232.)

2835. "Electric-discharge tubes and devices comprising such tubes." Mullard Radio Valve Co., Ltd. February 17th, 1939. (538207.)

3566. "Direct-current saturated inductance having a relay action." Allmänna Svenska Elektriska Aktiebolaget. March 3rd, 1939. (538237.)

3603. "Welding transformer with an adjustable series reactor." Allmänna Svenska Elektriska Aktiebolaget. March 9th, 1939. (538238.)

3877. "Thermal responsive switches." British Thomson-Houston Co., Ltd., H. R. Ruff and W. J. Scott. March 1st, 1940. (538239.)

3992. "X-ray apparatus." British Thomson-Houston Co., Ltd. March 6th, 1939. (538174.)

4241. "Vacuum vessels incorporating ball bearings or roller bearings." Philips Lamps, Ltd. March 9th, 1939. (538289.)

4678. "Electric fuseboards or boxes, switchboards, or boxes and the like." Walsall Conduits, Ltd., A. E. Millard and W. Whalley. March 13th, 1940. (538242.)

5222. "Washing machines." British Thomson-Houston Co., Ltd. March 25th, 1939. (538243.)

5418. "Electric torches." Notek Electric Co., Ltd., and R. P. H. Hinds. March 26th, 1940. (538213.)

5723. "Electric switches adapted for controlling a plurality of circuits." "Diamond H" Switches, Ltd., and C. A. Turner. March 29th, 1940. (538292.)

5752. "Metalclad draw-out electrical switchgear." D. R. Davies and Metropolitan-Vickers Electrical Co., Ltd. March 30th, 1940. (538244.)

5766. "Successive indication of a plurality of conditions." Marconi's Wireless Telegraph Co., Ltd. March 31st, 1939. (538214.)

6348. "Method of producing light-sensitive layers sensitised by means of an iron salt, and layers made thereby." Philips Lamps, Ltd. April 11th, 1939. (538245.)

6389. "Electric selective signalling systems." Ericsson Telephones, Ltd., and D. C. Crowe. April 9th, 1940. (538246.)

6410. "Wound condenser, and condenser type insulators." Micafil, Ltd. August 12th, 1939. (538147.)

7266. "Switching arrangements for frequency selection, particularly in wireless transmitters." Marconi's Wireless Telegraph Co., Ltd. April 22nd, 1939. (538149.)

7650. "Flameproof electric switchgear." English Electric Co., Ltd., A. R. Blandford and W. L. Johnson. April 29th, 1940. (538219.)

8059. "Television signal translating system." Hazeltine Corporation. May 31st, 1939. (538220.)

(*Continued on next page*)

COMMERCE and INDUSTRY

New Trade Regulations. Discharge-Lamp Manual.

East African Import Restrictions

THE Board of Trade has been notified of restrictions on imports of goods from the United Kingdom which are now being applied in the territory of Kenya, Tanganyika and Zanzibar. Import licences for goods from the United Kingdom will in future be confined to certain goods, including electrical goods and equipment (excluding certain classes) and radio sets. The importation of such goods will be permitted subject to limitations as to quantity provided that they are unobtainable from other sources within the sterling area and provided that indent on supplies is produced to the import controller at the time of application for an import licence.

Licence for Machine Tool Users

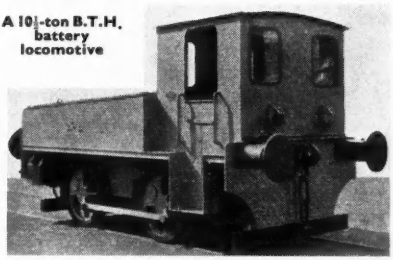
Under Statutory Rules and Orders, 1941, No. 1164, dated August 6th, 1941, a general licence is issued permitting the supply without Board of Trade licence of electrical machinery and plant of the kind specified in Class 53 of the Schedule to the Machinery, Plant and Appliance (Control) (No. 4) Order, 1941 (S.R. & O. 1941 No. 1063) when they are to be used in connection with, or as part of, machine tools.

United States Exports to Great Britain

The *Board of Trade Journal* states that the United States Department of State Bulletin contains information that general licences have been issued for the exportation to Great Britain of Diesel and Diesel-electric locomotives, and Diesel engines (marine and stationary). Electric generating sets powered by Diesel engines are covered by general licences previously issued for certain electrical machinery and apparatus.

Battery Industrial Haulage

Absence of fumes, grit and sparks, in addition to immediate availability for service, silence in operation and elimination of all stand-by losses, were among the reasons for the substitution of the 0–4–0 type 10½-ton battery locomotive illustrated for a Diesel locomotive. It has a wheel-base of 5 ft. 3 in. and gauge of 4 ft. 8 in., and is driven by a 20-HP traction motor supplied at 150–200 V from a 380-Ah 124-cell "Nife" battery and controlled by a modified standard tramway drum controller. Rheostatic and hand braking on all wheels is provided. The locomotive, which is capable of hauling 75 tons on the level, was supplied by the British Thomson-Houston Co., Ltd.



A 10½-ton B.T.H. battery locomotive

Electric-Discharge Lamps

A technical account of "Osira" and "Osram" fluorescent tubes and their operating equipment has been issued by the General Electric Co., Ltd., in the form of a booklet of 63 pages containing 40 illustrations (chiefly useful diagrams and curves) bearing the title of "Electric-Discharge Lamps." The authors, Messrs. V. J. Francis and H. G. Jenkins of the company's research laboratories, have succeeded in presenting the subject in a lucid and readable manner that will commend itself to all concerned in illumination matters.

The work is divided into five parts, in the first of which the production of light, the mechanism of the discharge, the spectrum and fluorescence are explained. This is followed by a discussion of the details of high-pressure mercury-vapour lamps and their performance, and of chokes, power-factor correction and DC operation. In the third part the construction, characteristics and operation of sodium lamps (including information on colour, efficiency and life) are dealt with. The next section is devoted to colour floodlighting and particulars are given of colours available and method of working.

The final part brings together existing data on fluorescent tubes obtained since their introduction about eighteen months ago, and also incorporates

---

New Patents (*Continued from page* 134)

8227. "Electric water heaters." H. A. Rush. May 7th, 1940. (538251.)

8259. "Fluorescent screens." British Thomson-Houston Co., Ltd. May 9th, 1939. (538178.)

8331. "Means for indicating the condition of lamps or other electrical apparatus on a vehicle." A. Middelkamp. May 11th, 1939. (538252.)

8818. "Operating mechanisms of electric motor controllers." British Thomson-Houston Co., Ltd. May 18th, 1939. (538254.)

9083. "Production of transient electric arcs." British Thomson-Houston Co., Ltd. May 23rd, 1939. (538154.)

9277. "Evacuation of X-ray tubes." British Thomson-Houston Co., Ltd. May 26th, 1939. (538257.)

1941

3619. "Electrical impulse generators." Standard Telephones & Cables, Ltd., R. M. Barnard and W. Kram. November 10th, 1939. (Divided out of 537142.) (538221.)

hitherto unpublished matter. Important characteristics of discharge lamps are conveniently summarised in an appendix. A second appendix deals with distribution of energy throughout the spectra. Those who wish to go more deeply into the various aspects are likely to find the bibliography a helpful addition.

Exports to Japan Banned

Last week the Board of Trade made an Order prohibiting as from August 15th, the export of goods to Japan and territories under its rule except under licence from the Board.

Insulating Cloth Unrationed

Among articles and fabrics added to the schedule of articles exempted from rationing is insulation cloth, varnished or otherwise, treated for electrical purposes.

"Osram" Lamp Publicity

The successful phrase, "Light Up and Smile," is again being used in the forthcoming "Osram" lamp campaign. The scarcity of plywood, paper, etc., has not affected the quality of display material available, and the 1941-42 aids for the dealer are as bright and interesting as in previous years.

The principal display pieces again utilise the folding linen type of screen, about 5 ft. by 4 ft., printed in six bright colours. These window displays are made even more attractive by the judicious use of crêpe paper, lamps and showcards. With an eye for even more strict economy, much material has again been salvaged from displays used in previous campaigns. This is made possible by a successful process evolved by G.E.C. display artists of obliterating the designs on old showcards and overprinting a new design.

An "Osram" window display utilising the folding linen type of screen as a centre-piece

Cut-outs this year comprise one old friend and one which it is hoped will soon establish itself as a new friend. The latter is bold and luminous and puts over a forceful sales message with dignity. The other cut-out, devised to replace the dummy cartons which have always been a feature of "Osram" displays, is in effect a pyramid of "Osram" cartons surmounted by a crowner carrying the "Light Up and Smile" message. The familiar "Blitz" poster is being continued and, as a further aid, there is a smaller poster which will prove extremely useful for flanking blitzed windows.

Space restrictions in the newspapers must, of necessity, result in smaller displays, but despite this a lively and extensive advertising programme has already been arranged in the national and provincial Press, also using the "Light Up and Smile" theme. To reach the industrial and commercial lamp users there will be forceful announcements in the appropriate trade journals, while that new "Osram" fluorescent tube will continue to receive its appropriate share of publicity.

Aesthetics and the Engineer

In the article bearing this title in our last issue the captions to figs. 3 and 4 were confusing. The left-hand picture is, of course, the "departure from the imitative style," while the upper one illustrates a concession to public demand.

Metal-Sheathed Plastics

There are several means by which metallic coatings may be applied to insulating materials. Substances treated in this way are being increasingly used as alternatives to metals which are not easily obtainable. Weight, space, labour and cost may thus often be saved by rendering a surface conducting for earthing and similar purposes without drilling and screwing, for instance; or wireless sets and other electrical instruments may likewise be screened without adding barriers and enclosing cages.

There is a choice of materials, for the process developed by Plastic Spray, Ltd., 3, Vere Street, Oxford Street, London, W.1, is capable of coating phenol formaldehyde mouldings as well as cast resin products and laminated materials not only with zinc but also with aluminium, copper or tin. Success in zinc spraying is attributed to the extreme fineness of the metal powder employed. It is claimed that adhesion superior to that obtainable with galvanising is obtained while the union of the particles strengthens the surface.

Effective conductance and self inductance tests carried out at the National Physical Laboratory are stated to show that the electro-magnetic screening properties of sprayed zinc on bakelite are approximately the same as those of tinfoil of 0.02 mm. thickness. Should it be desirable to increase these properties, more than one coating could be sprayed on without appreciably raising the cost. Samples needed for tests can be made by hand in the company's workshops, according

to customers' blueprints and metal-coated to their requirements.

A Philips Ambulance Unit

A representative women's ambulance unit has been formed in connection with the works of Philips Lamps, Ltd., in a Northern town. Recently the members of this unit made their

The Philips women's ambulance unit on parade

first appearance in their new uniforms. They are eighty strong and for the time being are attached to the company's Home Guard. They receive first-aid training and instruction in military discipline, and all of them are qualifying for the St. John Ambulance Certificate. Quartermaster-Sergeant Dewhurst is in charge of the unit, with Mrs. Shannon (wife of Lieutenant Shannon) as hon. commandant. The girls are chosen from different departments of the works.

"Solon" Soldering Irons

Due to restrictions in the supplies of raw materials, Henley's are discontinuing the manufacture of the popular "Handyman" 65-W model "Solon" electric soldering iron. They are now concentrating on the range of industrial models, which includes various 65-W, 125-W and 240-W models suitable for a wide range of uses. The increasing cost of production has made some revision in the prices of the industrial "Solons" unavoidable, but at present only the 65-W models are affected. Full details are obtainable from W. T. Henley's Telegraph Works Co., Ltd., Milton Court, Westcott, Dorking, Surrey.

Change of Address

Aluminium Union, Ltd., has moved its London office to Grosvenor House (8th floor), Park Lane, London, W.1 (telephone, Grosvenor 4941). There is no change in the Company's Cobham address.

The Remainder Centre, Ltd., has moved to 2 & 3, Norfolk Street, London, W.C.2 (telephone: Temple Bar 9083).

New Catalogues and Lists

British Thomson-Houston Co., Ltd., Crown House, Aldwych, London, W.C.2.—Leaflet L716/M containing a message to directors and works managers of foundries explaining how B.T.H. light conditioning will increase industrial production.

Bowthorpe Electric Co., Ltd., Goodtric Works, Brewer Street, Oxford.—A 20-page illustrated catalogue of "Goodtric" overhead line fittings.

L. G. Hawkins & Co., Ltd., 30-35, Drury Lane, London, W.C.2.—Particulars of the company's A.R.P. shelter lighting transformer conforming to BS/ARP.794, the 1941–42 "Supreme" electric fires and a new adjustable factory bench and wall bracket lighting fitting.

TRADE MARK APPLICATIONS

AMONG recent applications for British trade marks are the following, objections to which may be entered within a month of August 13th:—

DORMAN DIOLUX. No. 614958, Class 11. Electric lamp fittings. Dorman & Smith, Ltd., Ordsal Electrical Works, Middlewood Street, Salford, 5.

CALECTRIC. No. 615173, Class 11. Electric radiators. Standard & Pochin Bros., Ltd., Evington Valley Road, Leicester.

INFORMATION DEPARTMENT

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding makers of the following:—

Twin "tinsel" flex, ¼ in. diameter, tough-rubber covered, each core enclosed separately in rubber sheath, made up of many very fine copper strips individually wound on cotton threads.

HAMMOND clocks (distributors of).

KLINGFAST adhesive tape.

ELECTRICITY SUPPLY

Manx Board's Report. Algerian Power Schemes.

Colchester. — UNDERTAKING'S FINANCES. — Alderman Owen Ward, chairman of the Electricity Supply Committee, stated at a recent meeting of the Town Council that the Committee had considered the accounts of the Electricity Department for the past year, which were, generally speaking, satisfactory. There was a surplus which was carried forward.

TARIFF INCREASE AMENDED.—Last year an addition of 15 per cent. was made to consumers' accounts, except in the case of lighting-only consumers in the extended area. It has now been decided that the increase shall not be applied to meter rents and charges for the hire of apparatus. A report is to be prepared on the various tariffs now in force.

Durham.—SUPPLY TO HOSPITALS.—The County Council has approved draft agreements with the North-Eastern Electric Supply Co., Ltd., for the supply of electricity to two hospitals.

Huddersfield. — SWITCHGEAR EXTENSION. — Sanction has been obtained by the Town Council to a loan for switchgear and for modifying certain circuit-breakers at the station.

Hyde.—ROAD EXCAVATIONS.—The Corporation Highways Committee reports that the Post Office Engineering Department and the North Cheshire & District Gas Co. have agreed to display a notice indicating the responsible authority when excavating in the streets of the town. The Stalybridge, Hyde, Mossley and Dukinfield Joint Transport and Electricity Board, however, has declined to accede to the Corporation's request, and the Town Clerk has been directed to communicate with the Board asking that the decision should be reversed.

Inverness.—CHEAPER ELECTRICITY.—The Electricity Department has announced a new scale of charges which reduces the lighting flat rate in the burgh from 5d. to 4½d. per kWh and in the outer areas from 5½d. to 5d.

Isle of Man.—BOARD'S BULK SUPPLY COSTS.—In reviewing the Electricity Board's accounts for the year ended March 31st last the auditors point out that the basis for ascertaining the amounts chargeable by Douglas Corporation is still in dispute. The Board estimates that £5,714 is the maximum additional amount which may become payable in respect of the past year, and this sum has been charged in the revenue account. In its accounts for 1939-40 the Board included £6,386 to cover additional amounts estimated to be demanded by Douglas Corporation, whose actual demand amounted to £5,936. The Board, however, considers that only £4,652 is due, and has transferred the £1,734 difference between this sum and the £6,386 allowed for to the net revenue account for the past year. The auditors therefore point out that no provision is made for the difference between the estimates of the Board and Douglas Corporation.

Including this sum of £1,734, there was a total surplus on revenue account last year of £15,115. After meeting all charges and setting aside £1,445 for storm damage repairs there was a balance of £197 to transfer to the reserve fund. No increases were made in charges during the year.

The Board's report shows that 4.3 million kWh was sold compared with 3.8 million kWh in the previous year in spite of a considerably reduced supply to the Manx Electric Railway. New consumers numbered 214, making altogether 4,408, and cookers on hire increased from 778 to 938.

It is reported that six miles of line damaged by snowstorm have been rebuilt and sectionalised so as to localise any further trouble.

London.—STOKE NEWINGTON.—The Council's policy with regard to electricity charges was the subject of a recent report by the Emergency Committee, which stated that in the absence of a definite order no further increase in charges could be introduced without prior consultation with the Electricity Commissioners. Councillor Watts said he was pleased that this step had been taken and wondered whether the Committee could go further and make some reduction in charges to those people who had to use electricity all day owing to their windows being boarded up as a result of war damage. Councillor Gordon intimated that this would be considered.

Perth.—ELECTRICITY CHARGES.—It is reported that no alteration in electricity charges is contemplated by the Council.

Stalybridge. — ALLOCATION OF SURPLUS REVENUE.—The Stalybridge, Hyde, Mossley and Dukinfield Joint Transport and Electricity Board is to grant £2,000 to each of the constituent authorities out of surplus revenue for the year ended March 31st last.

Winchester. — TARIFF ALTERATION. — Because the necessary recording instruments for the "all in" business and two-part motive-power tariffs are unobtainable the city electrical engineer has recommended that the following alternatives should be offered to consumers who wish to change to either of the tariffs in question: "All-in" business tariff, ¾d. per kWh and a fixed quarterly charge of 7s. per 100 W of lighting maximum demand, this charge being determined either by demand indicator or assessment of lighting wattage installed, as the Corporation may decide. Motive-power, 1d. per kWh and a fixed quarterly charge of 25s. per kW of maximum demand, 17s. 6d. per kVA of m.d., or 17s. 6d. per horse-power installed, to be determined either by demand indicator or on the total horse-power of motors installed.

Overseas

Algeria.—PLANS TO PROCEED.—A power congress was recently held in Algiers and was attended by General Weygand, Commissioner for North Africa. He said that the Government was willing to proceed with all its electric power plans and that 3 milliards of francs had been allocated for the purpose. Exactly what the plans are was not divulged, but it is known that there will be a

development in both thermic and hydraulic plants and that the Algeria, Morocco and Tunis networks will be linked up. Further, the electrification of the railways is to be speeded up and extended and, finally, the use of solar energy is to be thoroughly examined and reported on.

India.—MUNNAR HYDRO-ELECTRIC SCHEME.—It is reported in *Indian Engineering* that good progress is being made with the Munnar hydro-electric scheme in Travancore State. The head available where the river descends from the hills to the plains will be utilised for developing 12,000 BHP. A 10,000-ft. tunnel has been built to connect the offtake from the channel into which the river water is diverted by a weir to the pipe-line forebay. The pipe-line itself comprises two pipes 7,700 ft. long. The net effective head of the turbines is 1,877 ft.

An Air Ministry communique last week reported that on Tuesday morning Blenheims of Bomber Command penetrated into the Rhineland to attack the important Cologne power stations at Knapsack and Quadrath. The photograph shows bombs bursting on the Fortuna power station at Quadrath.

TRANSPORT

Blackpool.—TRAMWAY EXTENSION PROPOSAL.—A projected extension of the Corporation's tramway system from Lytham Road along Squires Gate Lane to the Half Way House was discussed at a recent meeting of Lytham St. Annes Town Council, when the Town Clerk reported on correspondence between the general manager of the Blackpool Transport Department and the Regional Transport Commissioner. According to the *Passenger Transport Journal*, the Town Clerk was authorised to inform the Blackpool Corporation that the Transport Committee did not wish to express any opinion regarding this proposal until it had had an opportunity of considering the matter in detail, but that it would be pleased if details of the scheme could be given for consideration in the event of the proposal going forward.

Fleetwood.—OPTION TO PURCHASE TRAMWAYS.—The Ministry of War Transport has extended by three years the time limit during which the Council may take steps to acquire Blackpool Corporation tramways inside the Fleetwood boundary. Blackpool Corporation opposed the extension. At a meeting of Fleetwood Council on August 14th, Alderman Saer said that as the matter would form the subject of further negotiation between the two Corporations, there should be no discussion.

Hull.—PROPOSED NEW TROLLEY-BUS ROUTE.—The Corporation Transport Committee is to convert the Anlaby tram route to trolley vehicle operation at a cost of £3,354.

Sunderland.—TRAMWAYS PLANT.—The Town Council is to install a rotary convertor in the tramway buildings at a cost of £1,900.

TELEPHONY

United States.—TELEPHONE CONSTRUCTION.—Plans for new telephone construction to the value of nearly $5,000,000 have been approved by the Federal Communications Commission, learns *Reuter's Trade Service* from New York. The largest item is the joint application of the American Telephone and Telegraph Co. and the New England Telephone and Telegraph Co. to supplement existing facilities between Boston, Mass., and Brunswick, Me., at an estimated cost of $2,279,800, of which $698,600 will be required for laying a cable over a distance of about 145 miles. The American Telephone and Telegraph Co. is also authorised to improve facilities between Salt Lake City, Utah, and the Idaho-Oregon State line, by installing open wire for about 464 miles, building 302 miles of new pole line, and installing carrier equipment. This project will link up with new construction of the Pacific Telephone and Telegraph Co. from the Idaho-Oregon State line to Hood River, Ore., authorised at the same time. The latter will consist of an open wire line for 307 miles and four miles of cable.

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

The Brush Electrical Engineering Co., Ltd., reports an increase in trading profit of £59,855 to £127,620 for 1940, which, with interest and other credits, makes the total income £129,879, as compared with £68,359. The net profit is £52,544, an increase of £20,839. The preference dividend, less tax, absorbs £6,325, and the following allocations have been made:—Amount written off patents and goodwill, £10,568; off A.R.P. expenditure, £7,740; war damage insurance, £2,760; general reserve, £25,000. The balance remaining (£151) is added to the carry-forward, making £11,039.

W. T. Henley's Telegraph Works Co., Ltd., reports a net profit for 1940 of £320,566, as compared with £343,853 for 1939. The ordinary distribution for the year is maintained at 20 per cent., by a final dividend of 10 per cent. and a cash bouus of 5 per cent., £50,000 is transferred to war contingencies reserve (against £100,000 to general reserve) and £382,397 is carried forward (against £380,831 brought in).

The Metropolitan Electric Cable & Construction Co., Ltd., reports a profit for 1940 of £33,996, to which is added £3,595 brought in, making £37,591. After providing for taxation, £18,742, and preference dividend, £2,846, and transferring £9,000 to preference share reserve and £1,000 to general reserve, it is proposed to pay a final ordinary dividend of 5 per cent., again making 7½ per cent. for the year, and to carry forward £1,503.

The Cawnpore Electric Supply Corporation Ltd., held its annual meeting on August 14th when Mr. K. A. Scott-Moncrieff (chairman) who presided, said that the consent of the Treasury was obtained at the end of June to raise £150,000 of new capital to finance the provision of additional plant and mains, and they had placed on the London Stock Exchange 118,500 ordinary shares at 25s. 3d. per share. These new shares would rank for dividend in the 1941 accounts. During the year under review, and during the current year up to date, they had not obtained the full benefit of the plant recently provided, one reason being that the generating set shipped in the latter part of 1939 was not yet in service. Their revenue during the present year showed a satisfactory increase, but costs also were rising.

The Delhi Electric Supply & Traction Co., Ltd., reports a revenue for 1940 of £55,988, as compared with £53,690 for 1939, and a net profit of £17,869 (against £21,810). The final dividend is 5 per cent., making 9 per cent., tax free, for the year (unchanged), and the balance carried forward is £24,543 (against £24,674 brought in).

The Electrolux Corporation reports a profit for 1940, after providing for all charges including federal income tax, of $1,397,165, a decrease of $261,304, as compared with the previous year. There was a 4.5 per cent. reduction in sales, computed on a dollar basis, but this was more than offset by a decrease in manufacturing costs. Earnings per share were $1.13 (against $1.34).

The County of London Electric Supply Co., Ltd., is again paying an interim dividend of 3 per cent.

The Bournemouth & Poole Electricity Supply Co., Ltd., is maintaining its interim dividend at 5 per cent.

The Richmond (Surrey) Electric Light & Power Co., Ltd., has declared an interim dividend of 2 per cent. (unchanged).

The Northampton Electric Light and Power Co., Ltd., has declared an interim dividend of 4 per cent. on the ordinary stock (unchanged).

The Rushden & District Electric Supply Co., Ltd., is paying an interim dividend of 4 per cent., less tax (same).

Chadburn's (Ship) Telegraph Co., Ltd., is paying a dividend and bonus of 10 per cent. (against 6 per cent. and a bonus of 6½ per cent.).

James Howden & Co., Ltd., have announced a first and final dividend of 15 per cent. (same).

Hoover, Ltd., has declared an interim dividend of 3½ per cent. (unchanged).

Pye, Ltd., has announced a first and final dividend of 25 per cent. (unchanged).

Waste Heat & Gas Electrical Generating Stations, Ltd., is maintaining its interim dividend at 2½ per cent.

Davis & Timmins, Ltd., are again paying an interim dividend of 10 per cent.

New Companies

Ysputty Electricity, Ltd.—Private company. Registered August 13th. Capital £600. Objects: To carry on the business of suppliers of light, heat and power, manufacturers of, and dealers in, telephones, wireless and other telegraphs, dynamos, accumulators, etc. John Lloyd, Fron Deg, Yspytty, Bettws-y-Coed, is permanent governing director and chairman. Solicitors: R. C. Bartlett & Co., 27, John Street, Bedford Row, W.C.1.

Langdale Engineering, Ltd.—Private company. Registered August 7th. Capital £1,000. Objects: To carry on the business of electrical, mechanical and general engineers, tool makers, metal workers, etc. Subscribers: H. M. Thring, 18, Essex Street, W.C.2, and C. F. Cherry, 81a, St. Julians Farm Road, S.E.27. Solicitors: Kenneth Brown, Baker, Baker, Essex House, Essex Street, W.C.2.

"Reltone" Engineering Co., Ltd.—Private company. Registered August 9th. Capital £200. Objects: To carry on the business of general and electrical engineers, etc. Directors: A. L. Butler, 12, Jutland Road, Billesley, Birmingham, and H. Butler, 93, Coldbath Road, Kings Heath, Birmingham.

Bignell & New, Ltd.—Private company. Registered August 9th. Capital £3,000. Objects: To acquire the business of electrical engineers carried on by C. R. Bignell and E. J. New at 1, Wellington Road, Uxbridge, Mdx. Directors: C. R. Bignell, 1, Wellington Road, Uxbridge, Mdx., E. J. New, 18, Chippendale Waye, Ux-

bridge, and T. A. Mayhew, 28, Bolton Avenue, Windsor, Berks. Registered office: 1, Wellington Road, Uxbridge, Middlesex.

Paxford Electrical, Ltd.—Private company. Registered August 9th. Capital £100. Objects: To carry on the business of manufacturers of, and dealers, in electrical accessories, cells, accumulators, batteries, etc. Subscribers: A. Davis, 58, Paxford Road, N. Wembley, Middlesex, and F. Feldman, 84a, Lordship Park, N.16. Secretary: F. Feldman. Solicitors: Byre, Cohen & Co., 1/3, St. Paul's Churchyard, E.C.

Highgate Precision Co., Ltd.—Private company. Registered August 7th. Capital £100. Objects: To carry on the business of electrical, mechanical and general engineers, etc. Directors: W. Hyams, 1, Conduit Buildings, Floral Street, W.C.2; and A. Barnett, 79, North End Road, N.W.11. Solicitors: Crane and Hawkins, Bush House, Aldwych, W.C.2.

Companies' Returns

Statements of Capital

English Electric Co., Ltd.—Capital, £5,000,000 in £1,500,000 preference stock and £3,500,000 ordinary stock. Return dated March 6th, 1941. £1,135,844 preference and £1,922,513 ordinary stock taken up. £1,381,659 10s. paid. £1,676,697 10s. considered as paid. Mortgages and charges: £1,384,000.

Allbright Electric Co., Ltd.—Capital £20,000 in 20,000 shares of £1 each. Return dated March 20th, 1941. All shares taken up. £14,000 paid. £6,000 considered as paid. Mortgages and charges: Nil.

Trent Valley & High Peak Electricity Co., Ltd.—Capital £200,000 in £1 shares. Return dated April 2nd, 1941. All shares taken up. £210,666 13s. 4d. paid (including 2s. 8d. per share premium on 80,000 shares). Mortgages and charges: Nil.

Edison Swan Electric Co., Ltd.—Capital £432,565 8s. in 300,000 ordinary shares of £1 and 662,827 ordinary shares of 4s. Return dated April 2nd, 1941. 300,000 £1 ordinary shares issued and fully paid up. Mortgages and charges: Nil.

Concordia Electric Safety Lamp Co., Ltd.—Capital £100,000 in £1 shares. Return dated April 2nd, 1941. All shares taken up. £100,000 paid. Mortgages and charges: Nil.

Brentford Electric Supply Co., Ltd.—Capital £100,000 in ordinary shares of £1 each. Return dated March 18th, 1941 (filed April 7th, 1941). 90,000 shares taken up. £90,000 paid. Mortgages and charges: Nil.

British Insulated Cables, Ltd. — Capital £3,000,000 in £500,000 5½ per cent. "A" preference stock, £500,000 6 per cent. preference stock and £2,000,000 ordinary stock. Return dated April 15th, 1941. All preference and ordinary stock taken up. £2,572,675 paid. £427,325 considered as paid. Mortgages and charges: £700,000 redeemed January 3rd, 1940, with the exception of £1,000.

Elexcel, Ltd.—Capital £250,000 in 125,000 cumulative preference and 125,000 ordinary shares of £1. Return dated April 17th, 1941. 125,000 ordinary shares taken up. £2 paid. £124,998 considered as paid. Mortgages and charges: Nil.

Waste Heat & Gas Electrical Generating Stations, Ltd.—Capital £350,000 in £160,000 ordinary stock, £80,000 4 per cent. cumulative preference stock and 110,000 shares of 10s. each. Return dated April 11th, 1941. All ordinary and preference stock taken up. £160,000 paid on the ordinary stock, £80,000 considered as paid on the preference stock. Mortgages and charges: Nil.

Gent & Co., Ltd.—Capital £70,000 in 10,000 preference and 60,000 ordinary shares of £1 each. Return dated April 9th, 1941. 7,427 preference and 48,752 ordinary shares taken up. £13,387 paid on 3,957 preference and 9,430 ordinary shares. £42,792 considered as paid on 3,470 preference and 39,322 ordinary shares. Mortgages and charges : £9,000.

J. G. Sneath, Ltd.—Capital £3,000 in £1 shares. Return dated April 16th, 1941. All shares taken up. £1,969 paid. £1,031 considered as paid. Mortgages and charges: Nil.

Increases of Capital

Adamson, Green & Co., Ltd.—The nominal capital has been increased by the addition of £4,000 in £1 ordinary shares beyond the registered capital of £1,000.

D.C. Engineering Co., Ltd.—The nominal capital has been increased by the addition of £2,000, in £1 ordinary shares, beyond the registered capital of £2,000.

Mortgages and Charges

Homefyre, Ltd.—Satisfaction in full on July 18th, 1941, of debentures, authorised May 1st, 1934. (According to the register of mortgages the debentures registered May 3rd, 1934, originally secured £1,300.)

Holfords, Ltd.—Issue on July 30th, 1941, of £50 debentures, part of a series already registered.

Bankruptcies

G. W. Linsell, Tippendale Lane, Park Street, near St. Albans, Herts, lately carrying on business at 26, London Road, St. Albans, Herts, radio and electrical dealer.—This debtor applied for his discharge recently at the Court House, Town Hall, St. Albans. The Official Receiver reported that the receiving order was made on a creditor's petition in April, 1937, when the statement of affairs disclosed ranking liabilities of £1,442. Proofs actually admitted, however, amounted to £1,460, with probable claims not yet admitted of £89. The assets were estimated by the debtor at £627, but they had only realised £170. A first and final dividend of 4d. in the £ had been paid on proofs for £1,460. The discharge was granted, subject to one month's suspension.

G. H. Morris, 16, Tontine Street, 1, Tontine Street, and 26, Tontine Street, Folkestone, electrical engineer, etc.—Debtor's application for discharge was heard at the Guildhall, Canterbury, recently. It was reported that the receiving order was made in 1937. It appeared that debtor had carried on business successively at Ware, Herts, Sandgate, and Folkestone. He had borrowed money, those loans totalling approximately £1,490. He attributed his failure to losses on hire-purchase transactions, ill-health, and decline of Tontine Street as a trading centre. The discharge was granted subject to fourteen days' suspension.

STOCKS AND SHARES

TUESDAY EVENING.

THE consequence of the withdrawal of the 2½ per cent. National War Bonds, 1946-1948, has been to strengthen the prices of existing securities which, just previously, had been inclined to waver a little because of the uncertainty induced by Japanese news. Prices are well maintained in the markets with which these paragraphs principally deal, and although no spectacular changes have occurred, it will be observed that for the third consecutive week rises substantially outnumber falls.

Home Railway and Transport Stocks

London Passenger Transport "C" stock has advanced 3 points to 4½, and although the new agreement with the Government has not even yet been published, anticipation flirts with the idea, quoted here last week, that the Government's attitude towards the railway companies is likely to prove friendly. Something of a halt has been called to the advance in the prices of the junior Home Railway issues, but Southern preferred is 1 higher at 56½, although the 5 per cent. preference stock is a point down at 96½. Thomas Tilling shares maintain their improvement at 45s. British Electric Traction deferred revolves around 860.

Electricity Supply

Most of the electricity supply companies are declaring the same interim dividends as those of a year ago, with the result that shareholders' confidence is confirmed in the security of their investments. From the yields now obtainable upon shares in the best-class supply companies it might be supposed that inquiry would be checked by the comparative modesty of the returns, or, in other words, by the high prices which now obtain. On the contrary, however, the buying persists.

County of London ordinary are ⅛ up, at 34s. 6d.; Midland Electric Power show ¼ rise at 37s. 6d.; Northmet Power and Clyde Valley have each put on ⅛. Amongst overseas shares, Victoria Falls at 78s. 9d. pursue their upward course. Calcutta Electrics have hardened to 36s. 6d.

River Plate Telephone

The United River Plate Telephone Company supplements the preliminary figures, which appeared last May, with fuller details. The dividend for the year is raised by 2 per cent. to 6 per cent. and the carry forward of £2,113,682 is nearly £400,000 higher. Very rarely does it happen that United River Plate ordinary come to market. The nominal quotation for the £5 shares is 4 to 5, or, on the basis of the stock price, 80 to 100. The figures just published would seem to justify a higher value, but there is no market in the shares owing to the fact that by far the greater part of them are in the hands of the I.T.T.

Price Fluctuations

Consolidated Signal shares at 68s. 9d. show a rise of half-a-crown, which is a natural corollary to the advance of 3s. which Westinghouse Brakes made last week to 45s. S. Smith 1s. shares have risen ⅛ to 7s. 6d. and British Aluminium are better at 47s. Enfield Cables, with a further rise of ⅛, now stand at 51s. 3d. Murex have advanced to 88s. 9d., and are in short supply. There is some talk of a possibility of the company's 20 per cent. dividend being increased, although, under war conditions, this would seem to be unlikely. Cable and Wireless preference and ordinary are both a little better. Globe ordinary held their improvement at 28s. 9d.

International Combustion shares at 5¼ show a gain of the fraction. Lucas shares have improved to 60s. The Anglo-American agreement announced last week aroused great interest, but it had no effect upon Stock Exchange prices.

Henley's

The Stock Exchange market, and doubtless the shareholders in the company, are pleased with the results announced by W. T. Henley's Telegraph Works Co. for the year ended December, 1940. The net profit is slightly lower at £320,600, but this is negligible in view of the extra £9,000 which went in depreciation. The ordinary dividend takes £260,000 as usual, and the carry forward, at £282,400, is little less than that of a year ago. Maintenance of the dividend at 20 per cent. gives the shares a yield, at their present price of 21s. 3d., of nearly 4¾ per cent., which is not a bad return, as things go, upon the ordinary shares of one of the front rank industrial companies.

Brush Electrical

The better showing made by the annual report of the Brush Electrical Engineering Co. has had the effect of directing attention to the shares as a speculation, and of bringing about a few ha'pence recovery. Shares have been changing hands at 3s. 4½d.; buyers are now asked 3s. 6d. for these £1 units. The preference shares are privately held. That there should be some inquiry for the ordinary shares is not surprising, in view of the low price to which they have fallen, and of the popularity which attends upon shares in companies engaged in similar or kindred business. As a speculation, Brush may be, one of these days, worth 5s. or more, and holders are naturally loth to part from their interest when their company may enjoy better times.

Ordinary Shares on Offer

To give an idea of what is actually available in the Stock Exchange market at the moment, it may be of service to set out the following selection from a list of ordinary shares on offer.

(*Continued on page* 144)

ELECTRICAL INVESTMENTS

Prices, Dividends and Yields

Company	Dividend 1939–40	Dividend 1940–41	Middle Price Aug. 19	Rise or Fall	Yield p.c. £ s. d.
Home Electricity Companies					
Bournemouth and Poole	15	12½	50/9	..	4 18 5
British Power and Light	7	6	25/–	..	4 16 0
City of London	7½	7	25/–	..	5 12 0
Clyde Valley	8	8	37/–	+⅛	4 6 6
County of London	10½	8	34/6	+⅛	4 12 10
Edmundson's:					
7% Pref.	7	7	31/3	..	4 9 7
Ord.	6	6	27/–	..	4 9 0
Elec. Dis. Yorkshire	9	9	38/9	..	4 3 0
Elec. Fin. and Securities	12½	12½	42/6	..	5 17 8
Elec. Supply Corporation	11½	10	40/9	+9d.	4 18 0
Isle of Thanet	2	Nil	8/6	..	—
Lancs Light and Power	7½	7½	32/6	+6d.	4 12 4
Llanelly Elec.	5½	5½	20/–	..	5 10 0
Lond. Assoc. Electric	5½	4½	18/3	+9d.	4 18 8
London Electric	7	7	23/9	..	5 18 0
London Power Deb. Red.	5	5	104	..	4 16 2
Metropolitan	10	8	33/9	+6d.	4 14 10
Midland Counties	8	8	37/–	..	4 6 5
Mid. Elec. Power	9	9	37/6	+⅛	4 16 0
Newcastle Elec.	7	7	27/6	..	5 1 10
North Eastern Elec.:					
Ordinary	7	7	29/6	..	4 15 0
7% Pref.	7	7	33/3	..	4 4 2
Northampton	10	10	43/9	..	4 11 5
Notting Hill 6% Pref. (£10)	6	6	8½	..	—
Northmet Power:					
Ordinary	10	7	34/6	+⅛	4 1 2
6% Pref.	6	6	29/6	..	4 1 4
Richmond Elec.	6	6	22/6	..	5 6 8
Scottish Power	8	8	37/–	..	4 6 5
Southern Areas	5	5	16/3	..	6 3 0
South London	7	7	23/6	..	5 19 2
West Devon	5	5	21/3	..	4 14 1
West Glos.	4½	4½	18/3	..	4 18 8
Yorkshire Elec.	8	8	38/3	..	4 4 0
Overseas Electricity Companies					
Atlas Elec.	Nil	Nil	2/6	..	—
Calcutta Elec.	8*	7*	36/6	+6d.	3 16 9
Cawnpore Elec.	10	10	27/6	..	7 5 9
East African Power	7	7	25/9	..	5 8 9
Jerusalem Elec.	7	7	18/9	..	7 9 4
Kalgoorlie (10/–)	7½	7½	12/6	..	6 0 0
Madras Elec.	6*	4*	23/–	..	3 9 7
Montreal Power	1½	1½	24½	..	6 2 5
Palestine Elec. "A"	Nil	Nil	18/3	..	—
Perak Hydro-elec.	2½	6	17/6	..	6 17 2
Shawinigan Power	83cts.	90cts.	14½	..	—
Tokyo Elec. 6%	6	6	30½	..	19 13 4
Victoria Falls Power	15	15	78/9	+⅛	3 16 2
Whitehall Inv. Pref.	7½	7½	13/9	..	10 18 2

Company	Dividend 1939–40	Dividend 1940–41	Middle Price Aug. 19	Rise or Fall	Yield p.c. £ s. d.
Public Boards					
Central Electricity:					
1950–70	5	5	110	..	4 11 1
1955–75	5	5	113	..	4 8 6
1951–73	4½	4½	107	..	4 4 1
1963–93	3½	3½	100½	..	3 9 8
1974–94	3½	3½	94	..	3 9 2
London Elec. Trans. Ltd.	2½	2½	94	..	2 13 2
London & Home Counties 1955–75	4½	4½	106½	..	4 4 6
Lond. Pass. Trans.:					
A	4½	4½	113½	..	3 19 4
B	5	5	109½	..	4 11 4
C	1½	3	41½	+3	7 4 7
West Midlands J.E.A. 1948–68	5	5	108½	..	4 12 0
Telegraph and Telephone					
Anglo-Am. Tel.:					
Pref.	6	6	107½	..	5 11 9
Def.	1½	1½	24½	..	2 5
Anglo-Portuguese	8	8	15/–	..	10 13 4
Cable & Wireless:					
5½% Pref.	4½	5½	103½	+½	5 6 3
Ord.	4	4	63½	+½	6 6 0
Canadian Marconi $1	Nil	4cts.	6/3	..	3 5 0
Globe Tel. & Tel.:					
Ord.	8½*	8½*	28/9	..	—
Pref.	6	6	27/6	..	4 7 3
Great Northern Tel. (£10)	20	20	12½	..	—
Inter. Tel. & Tel.	Nil	Nil	3	..	—
Marconi-Marine	7½	7½	26/3	..	5 14 3
Oriental Tel. Ord.	11½*	16	3½	..	5 2 4
Telephone Props.	6	6	11/3	..	10 13 4
Tele. Rentals (5/–)	10	10	7/3	..	6 18 0
Traction and Transport					
Anglo. Arg. Trams:					
First Pref. (£5)	Nil	Nil	2/–	..	—
4% Inc.	Nil	Nil	4½	..	—
Brit. Elec. Traction:					
Def. Ord.	45	45	860	..	5 4 8
Pref. Ord.	8	8	170	..	4 14 2
Bristol Trams	8*	8	41/3	..	3 17 8
Brazil Traction	$1	50c.	8¾	+¼	—
Calcutta Trams	8	5½	23/9	..	4 12 7
Cape Elec. Trams	5	5	17/–	..	5 17 4
Lancs Transport	10	10	40/–	..	5 0 0
Mexican Light:					
1st Bonds	5	5	45	..	—
Rio 5% Bonds	5	5	85	..	5 17 8
Southern Rly.:					
5% Prefd.	5	5	56½	+1	8 17 0
5% Pref.	5	5	96½	−1	5 3 7
T. Tilling	10	10	45/–	..	4 9 0
Tilling & B.A.	8*	7*	52/6	..	2 13 4
West Riding	10	10	38/–	..	5 5 4

(*Continued on next page*)

* Dividends are paid free of Income Tax.

Company	Dividend 1939–40	Dividend 1940–41	Middle Price Aug. 19	Rise or Fall	Yield p.c. £ s. d.
Equipment and Manufacturing					
Aron Elec. Ord.	Nil	7½	20/–	..	7 10 0
Assoc. Elec.:					
Ord.	10	10	42/6	..	4 14 3
Pref.	8	8	36/3	..	4 8 5
Automatic Tel. & El.	12½	12½	46/3	..	5 8 1
Babcock & Wilcox	11	11	45/–	..	4 17 9
British Aluminium	12½	10	47/–	+9d.	4 5 1
British Insul. Ord.	20	20	87/6	..	4 11 4
British Thermostat (5/–)	18¼	18¼	12/6	..	7 8 0
British Vac. Cleaner (5/–)	40	12½	6/3	..	10 0 0
Brush Ord.	Nil	Nil	3/–	..	—
Callender's	15	15	67/6	..	4 9 0
Chloride Elec. Storage	15	15	62/6	..	4 15 10
Consolidated Signal	17	17	68/9	+⅛	4 18 10
Crabtree (10/–)	17½	17½	26/3	..	6 13 4
Crompton Parkinson Ord. (5/–)	30	20	19/6	..	5 2 8
E. K. Cole (5/–)	10	Nil	6/6	–6d.	—
E.M.I. (10/–)	5	Nil	12/–	–3d.	—
Electric Construction	10½	10	32/6	..	6 3 0
Enfield Cable Ord.	16½	12½	51/3	+1/6	4 17 6
Elecl. Switchgear (10/–)	16	10	20/–	..	5 0 0
English Electric	10	10	35/–	..	5 14 2
Ensign Lamps (5/–)	25	25	16/3	..	7 13 10
Ericsson Tel. (5/–)	25*	22*	37/6	..	2 18 8
Ever Ready (5/–)	40	40	28/–	..	7 2 10
Falk Stadelmann	7	7½	17/6	..	8 11 6
Ferranti Pref.	7	7	26/3	..	5 6 10
G.E.C.:					
Pref.	6½	6½	32/6	..	4 0 0
Ord.	20	17½	80/–	..	4 7 6
Greenwood & Batley	15	13	22/6	..	11 11 2
Hall Telephone (10/–)	15	10	13/9	..	7 5 6
Henley's (5/–)	20	20	21/3	..	4 14 1
4½% Pref.	4½	4½	21/3	..	4 4 8
Hopkinsons	15	15	45/9	–6d.	6 11 0
India-Rubber Pref.	5½	5½	21/3	..	5 3 6
Intl. Combustion	32½	30	105/–	+½	5 14 3
J. Lucas	15	15	60/–	+1/6	5 0 0
Johnson & Phillips	15	15	51/3	..	5 18 10
Lancashire Dynamo	20	20	52/6	..	7 12 5
Laurence, Scott (5/–)	15	15	10/9	..	6 19 6
London Elec. Wire	7½	7½	22/6	..	6 13 4
Mather & Platt	13½	10	43/3	..	4 12 6
Metropolitan Elec. Cable Pref.	5½	5½	21/3	..	5 3 6
Murex	20	20	88/9	+½	4 10 1
Pye Deferred (5/–)	25	25	13/9	..	9 1 10
Revo (10/–)	5	20	23/9	..	8 8 5
Reyrolle	12½	12½	55/–	..	4 10 5
Siemens Ord.	7½	7½	25/–	..	6 0 0
Strand Elec. (5/–)	4	2	2/–	..	5 0 0
S. Smith (1/–)	37½	50	7/6	+1/6	6 13 1
Switchgear & Cowans (5/–)	10	15	8/9	..	8 11 6
Tel. Condenser (10/–)	Nil	5	11/3	..	4 9 0
T.C. & M.	10	10	40/–	..	5 0 0
Telephone Mfg. (5/–)	9	9	7/3	..	6 4 2
Tube Investments	23¾	23¾	95/–	..	5 0 0
Vactric (5/–)	4	Nil	2/6	..	—
Vickers (10/–)	10	10	16/3	–3d.	6 3 1
Ward & Goldstone (5/–)	20	20	16/6	..	5 19 9
Westinghouse Brake	17½	10	45/–	..	4 9 0
Walsall Conduits (4/–)	55	55	31/3	..	7 0 9
West, Allen (5/–)	7½	7½	3/9	..	10 0 0

* Dividends are paid free of Income Tax.

Stocks and Shares (*Concluded from page* 142)

The difference between most of the prices in the following table and those which appear in our price list is due to the fact that the ELECTRICAL REVIEW quotations are the middle prices, whereas the buyer, as he usually finds to his cost nowadays, has to pay well above the middle price for the particular shares which he requires. The returns on the money range from 4½ per cent. on British Insulated to 6⅔ per cent. on Telephone Rentals:—

Company	Price s. d.	Div. %	Yield £ s. d.
British Insulated	88 6	20	4 10 5
Chloride Elec.	64 0	15	4 13 9
Crompton "A"	20 0	20	5 0 0
Ericsson	39 6	22	2 15 8
Henley's	21 6	20	4 13 0
Johnson & Phillips	51 9	15	5 15 10
Siemens	25 0	7½	6 0 0
Telegraph Construction	42 0	10	4 15 3
Telephone Rentals	7 6	10	6 13 4

Cawnpore Electric

Notice was drawn last week to the prosperity which most of the Indian industrial companies are now enjoying, thanks mainly to war conditions that have stimulated activity in a variety of directions. The Indian electricity supply companies participate in this expansion and, at the recent meeting of the Cawnpore Electric Supply Corporation, the chairman's address made reference to the satisfactory increase in the sale of electricity during the year under review. The company required money in order to provide additional plant and mains, and application was made to the Treasury in August last year for permission to raise £150,000 new capital. Consent was not obtained until June 30th this year, nearly ten months later, but this was fortunate for the company because the terms it was then able to arrange were more favourable than could have been obtained in August, 1940.

Last month the company placed 118,500 ordinary shares in the London Stock Exchange at 25s. 3d., which realised £148,125. The company paid 3d. per share brokerage, which seems, by the way, a very handsome fee for an operation of this magnitude, to the success of which very little risk was attached. These new shares will rank for dividend in the current year's accounts, and they are quoted at a few pence under the price of the older issue.

Electrical Imports of Java

Lower Purchases in 1940

INVESTIGATION and development of water power for generating electricity have been encouraged by the Government for more than a quarter of a century in the Dutch East Indies. Suitable sources are plentiful, although stand-by plant—usually oil driven—has to be installed for use in the dry season. Linking of hydro-electric stations with large thermal plants is also practised. New stations and extensions of existing plants have been planned, but abnormal conditions governing the supply of machinery stand in the way of their execution. In recent years the establishment of secondary industries has furthered the movement towards the electrification of the territories, particularly Java. Without doubt the market holds great future promise after the war. Much of the production of the islands has been in extra demand since hostilities began. Export trade as a whole rose by 18 per cent. in 1940, larger shipments of tin, rubber, quinine and petroleum products having made up for decreased sales of agricultural produce. The accompanying statement, showing the chief groups of electrical imports into Java and Madura in 1940, have been extracted from the official trade statistics, and a note of increase or decrease compared with 1939 added. (7½ fl. equals approx. £1.) The electrical trade of Sumatra, Borneo and the Outer Possessions of Holland is recorded separately. In view of the policy laid down at the Delhi conference it is probable that until the war is over the Dutch East Indian market for the lighter electrical supplies will be the concern of Australia rather than that of Europe.

A recent article in the Trade and Engineering supplement of *The Times* assesses the total capacity of public and private generating plant, excluding installations of less than 25 kW, at considerably over 400,000 kW. Plant for public supply aggregates 180,000 kW, of which about 110,000 kW represents hydro-electric installations. It is estimated that the total potential capacity of water-power resources is about 3,400,000 HP, so that there is great scope for development. In Central Java and the Principalities the chief hydro-electric station is at Djelok, on the Toentang River, and contains three 4,800-kW sets. It is operated by the A.N.I.E.M., which also owns the Ketenger hydro-electric station on the Bandjaran River (two 3,500-kW sets) and together with certain thermal stations the system has an annual output of about 60 million kWh. In East Java the chief water-power plants are at Mendalan (four 5,600-kW sets) and Siman (two 3,600-kW sets) on the Konto River, which are owned by the N.I.W.E.M. They are linked with steam stations at Semampir and Sourabaya (13,000 kW) and an oil-engine station at Malang (1,400 kW), and the system supplies about 90 million kWh annually.

	1940 (Fl. 000)	Inc. or dec. on 1939
Electric cable—		
Total	1,087	+556
From Holland	607	+397
,, Japan	228	+228
,, Great Britain	99	− 17
,, Italy	81	− 9
Electrical installation material for building, unspecified—		
Total	632	− 18
From Holland	272	− 38
,, Germany	82	−178
,, Japan	27	+ 12
,, Italy	45	+ 41
Batteries for torches—		
Total	179	− 91
From China	71	− 35
,, Japan	75	− 19
,, Hong Kong	32	− 18
Accumulators—		
Total	347	+ 63
From United States	178	+ 73
,, Germany	20	− 61
,, Japan	56	+ 14
,, Australia	68	+ 62
Dynamos, motors, transformers, etc.—		
Total	639	− 78
From Holland	181	− 15
,, Germany	10	−240
,, Sweden	43	− 21
,, Switzerland	135	+ 95
,, United States	195	+140
Radio receivers combined with loud speakers—		
Total	595	−460
From Holland	557	−383
,, United States	30	+ 20
Radio apparatus and parts—		
Total	349	−631
From Holland	259	−571
,, United States	67	− 5
Radio valves—		
Total	578	−349
From Holland	518	−367
,, United States	24	+ 3
Electric lamps for cycles and torches—		
Total	116	− 71
From China	87	− 59
,, Japan	10	− 7
Electric lamps for motor cars—		
Total	34	− 8
From Holland	21	− 12
,, United States	9	+ 7
Electric lamps, other—		
Total	1,100	+ 92
From Holland	897	+165
,, Germany	25	− 89
,, Japan	40	+ 10
Electric pocket and cycle lamps with batteries—		
Total	102	− 68
From China	94	+ 34

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—SYDNEY.—November 13th. County Council. 33,000-V switchgear and associated equipment for Pyrmont power station. Specification 538.

Brighouse.—August 30th. Electricity Committee. 300-kVA transformer and switchgear. (August 8th.)

Manchester.—August 25th. Electricity Department. Rewiring consequent on alteration of system of supply on the premises of a brewery concern. Specification (£1 1s.) from Mr. H. C. Lamb, chief engineer and manager, Electricity Department, Town Hall.

New Zealand.—POSTS AND TELEGRAPH DEPT.—August 25th. Condensers and 3-conductor cords. August 29th. Cadmium-copper binders and tapes. September 1st. Tumbler switches and fuses. September 2nd. 60 tons of copper wire. September 5th. 60 miles of tinned copper wire.

AUCKLAND HARBOUR BOARD.—September 30th. Ten 5-ton electric cranes.

South Africa.—SALISBURY (S. RHODESIA).—September 29th. Two 2,500-kW turbo-alternators and exciters with complete condensing and auxiliary plant. (August 15th.)

Warrington.—September 1st. Electricity Department. Cables, earthenware conduits, slabs, tiles and covers. (August 8th.)

Orders Placed

Blackburn.—Town Council. Provisionally accepted. Low-pressure feed pipe work at the Council's generating station (£11,780).—Babcock & Wilcox.

Sunderland.—Town Council. Accepted. B.V.C. turbine-type portable industrial vacuum cleaning plant for the Transport Department (£86).—"V" Equipment and Engineering Co.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Accrington.—Alterations to Ritz Ballroom, Church Street, for use as British Restaurant; H. Sanderson, borough surveyor, Town Hall.

Ashton-under-Lyne.—Canteen and stores; R. Whiffen, Ltd.

Bishop Auckland (Co. Durham).—Three-bay fire station and 16 firemen's houses for U.D.C.; F. L. White, surveyor, U.D.C. offices.

Clay Cross.—British Restaurant in Market Street for U.D.C.; W. A. T. Lynam, surveyor, Council Offices, Clay Cross, near Chesterfield.

Coventry.—Canteens in about 30 public air-raid shelters; E. H. Ford, city engineer, Council House.

Dewsbury.—Day nursery, Huddersfield Road, Ravensthorpe; M. H. Forward, borough architect, Town Hall.

Dukinfield.—Reconstruction, cleansing depot; E. N. Stannion, borough surveyor, Town Hall.

Felling-on-Tyne.—School canteen facilities for the Education Committee; H. Fawcett, architect.

British Restaurant and community kitchens at Wardley and Windy Nook; U.D.C. surveyor.

Gateshead.—Conversion of premises into transport depot (£2,500); F. H. Patterson, borough engineer.

Additions to Bensham Hospital and British Restaurant in Redheugh Bridge Road; borough engineer.

Work now to be completed at the Sheriff Hill Hospital; Gibson Bros., contractors, Hill Heads, Whitley Bay.

Govan.—Canteen, Clyde Foundry; Harland & Wolff, Ltd., Helen Street.

Houghton-le-Spring (Co. Durham).—British Restaurants to be provided and equipped at Houghton and Shiney Row; V. J. Hunter, surveyor, U.D.C. offices.

Jarrow (Co. Durham).—Completion of 20 houses; J. S. Weir, borough engineer, Town Hall.

Longhorsley (Northumberland).—Land workers' hostel; R. Carse & Son, contractors, Oldgate, Morpeth.

Manchester.—Rebuilding works, Hendham Vale; H. Green & Sons, builders, Stocks Farm, Cheetham Hill Road.

Works extensions in the city; McCutcheon & Walsingham, architects, 1180, Chester Road, Stretford.

Maryport (Cumberland).—Houses for the North-Eastern Housing Association; G. M. Pearson & Sons, contractors, Houghton Road, Hetton-le-Hole.

Motherwell.—Workers' canteen for Colville's, Ltd. (£3,500); manager.

Norham (Northumberland).—Hostel for the Ministry of Agriculture; Tasker & Child, architects, 25, New Bridge Street, Newcastle-on-Tyne.

Northumberland.—Improvements to school canteens at Alnwick, Bedlington, Berwick, Blyth and Gosforth; county architect, Morpeth.

Tynemouth.—Restaurant, Front Street (£1,700); borough engineer, 19, Howard Street, North Shields.

Wallsend-on-Tyne.—Communal feeding centre near New Winning; J. A. Blench, borough engineer, Town Hall.

THE
ELECTRICAL REVIEW

Volume CXXIX — No. 3327

Friday, August 29, 1941

Contents

	Page		Page
Editorial — Chief Engineers' Salaries	147	Hammersmith Carries On	162
Gypsum Quarrying	149	Electricity and Optics	164
Correspondence	153	Insulating Oil Tests. By P. R. Coursey, B.Sc., M.I.E.E., and K. A. Gough, B.Sc., A.M.I.E.E.	165
Personal and Social	155	New Patents	168
Chief Engineers' Salaries	156	Lamp Publicity	169
Dnieper Hydro-electric Plant	157	Commerce and Industry	171
Testing Chain Links. By W. Bayliss	158	Electricity Supply	174
Central American Trade. By a South American Correspondent	159	Power Control in Japan	175
A "Creeping" Reactive Meter. By J. Peacock	161	Financial Section	176
		Electric Vehicle Association	181
		Contract Information	182
Classified Advertisements	63	Index to Advertisers	74

EDITORIAL, ADVERTISING AND PUBLISHING OFFICES: Dorset House, Stamford Street, London, S.E.1

Telegraphic Address: "Ageekay, Sedist, London." Code: A B C. Telephone No.: Waterloo 3333 (35 lines)
Registered at G.P.O. as a Newspaper and Canadian Magazine rate of postage. Entered as Second Class Matter at the New York, U.S.A., Post Office.

Subscription Rates, Postage free: United Kingdom, £1 14s. 8d.; Canada, £1 12s. 6d.; Colonial and Foreign, £1 14s. 8d. per annum.

Cheques and Postal Orders (on Chief Office, London) to be made payable to ELECTRICAL REVIEW LTD., and crossed "Lloyds Bank"

Dowsing's

ELECTRICAL MANUFACTURERS

AN APOLOGY

We regret that, in spite of every effort, we have been unable to increase production sufficiently to supply all demands for "Dowsing" products.

We sincerely hope all those who have shown such preference for our products will appreciate the exigency of the present time and when more favourable conditions prevail they will remember the virtues of our manufactures.

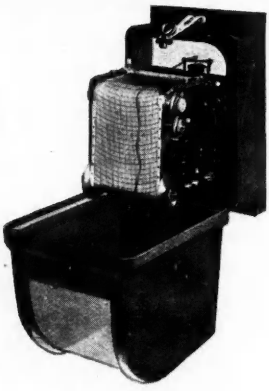
DOWSING COMPANY (ELECTRICAL MANUFACTURERS) LTD.

KANGLEY BRIDGE ROAD, LOWER SYDENHAM, LONDON, S.E.26

Telephone: SYDENHAM 7016 (2 lines). Telegrams: "RADIOTHERM, FOREST, LONDON."

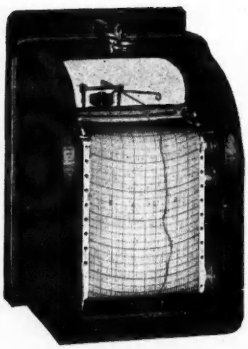
INKWELL GRAPHERS

embodying the following exclusive features :—



- Instantaneous response — the pen travels across the chart in less than $\frac{1}{10}$ second with no overswing.
- Low power consumption — A.C. Ammeters take less than 0.5 watt.
- High-efficiency magnetic damping — ensures faithful records of widely varying loads.

These important improvements in grapher design, coupled with the well-known advantages of the INKWELL pattern, have resulted in many interesting developments including :—



- **INKWELL FAULT GRAPHERS** giving an exact record of the conditions leading up to and following a fault.
- **INKWELL TRACTION GRAPHERS** unaffected by acceleration and cornering of the vehicle.
- **INKWELL INTEGRATED FREQUENCY METER,** a remarkable aid to accurate frequency control, of which EVERETT EDGCUMBE are the pioneers.
- **INKWELL GRAPHIC PHOTOMETERS** recording variation in natural and artificial light.
- **INKWELL MODULATION GRAPHERS** in radio transmission.

EVERETT EDGCUMBE

Manufacturers of all kinds of indicating and recording electrical instruments and photometry experts

COLINDALE WORKS, LONDON, N.W.9

Phone : COLINDALE 6045